

Data Evaluation Record on the Toxicity of Dicamba DGA salt and Glyphosate potassium salt to Terrestrial Vascular Plants: Soybean Yield

PMRA Submission Number {.....}

EPA MRID Number 50958206

Data Requirement:

PMRA Data Code: 9.8.4 (TGAI) or 9.8.6 (EP)
EPA DP Barcode: N/A
OECD Data Point: IIA 8.12 (TGAI) and IIIA 10.8.1.1 (EP)
MRID: 50958206
EPA Guideline: 850.4150

Test material: Clarity® formulation (a.i. Dicamba DGA salt) Purity: 40.2% a.e. (w/w); 485 g/L
Roundup PowerMax® formulation (a.i. Glyphosate potassium salt)
Purity: 38.9% (w/w); 527 g/L

Common name: Dicamba DGA and Glyphosate acid

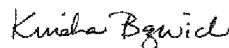
Chemical name: IUPAC: 3,6-Dichloro-o-anisic acid-2-(2-aminoethoxy)ethanol (Dicamba DGA)
N-(phosphonomethyl)glycine (Glyphosate)

CAS name: 2-(2-Aminoethoxy)ethanol;3,6-dichloro-2-methoxy-benzoic acid (Dicamba DGA)
N-(phosphonomethyl)glycine (Glyphosate)


CAS No.: 104040-79-1 (Dicamba DGA salt)
70901-12-1 (Glyphosate potassium salt)

Synonyms: Diglycolamine salt of 3,6-dichloro-o-anisic acid


Primary Reviewer: Kindra Bozicevich
Senior Scientist, CDM/CSS-Dynamac JV

Signature: 
Date: 3/23/20

Secondary Reviewer: Teresa Nelis
Senior Scientist, CDM/CSS-Dynamac JV

Signature: 
Date: 3/31/20

Primary Reviewer: Frank T. Farruggia, Ph.D.
Senior Scientist, EPA/OPP/EFED/ERB-1

Date: 9/3/20  2020.10.25 12:19:48
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Secondary Reviewer(s): {.....}
{EPA/OECD/PMRA}

Date: {.....}

This Data Evaluation Record may have been altered by the Environmental Fate and Effects Division subsequent to signing by CDM/CSS-Dynamac JV personnel. The CDM/CSS-Dynamac Joint Venture role does not include establishing Agency policies.

Reference/Submission No.: {.....}

Company Code: {.....} [For PMRA]
Active Code: {.....} [For PMRA]
Use Site Category: {.....} [For PMRA]
EPA PC Code: 128931 (for Dicamba DGA salt)

Date Evaluation Completed: 03-09-2020

CITATION: Jones, G.L., S. Castro-Tanzi, S. Whiting, and T. Wiekpe. 2020. Dicamba. Potential Effects of Clarity® (dicamba) Tank-Mixed with Roundup PowerMax® (glyphosate) on Non-Tolerant Dicamba/Glyphosate Tolerant Soybeans when Applied at Low Application Rates in the Field- Mississippi. Final Report. Unpublished study performed by Stone Environmental, Inc., Montpelier, Vermont, Eurofins EAG Agrosience, LLC, Columbia, Missouri, and Stewart Ag Research Farm Inc., Clarence, Missouri. Stone Study No.: Stone 19-077. Eurofins EAG Report No.: 89603. Task No.: TK0481088. Study sponsored by Syngenta Crop Protection, LLC, Greensboro, North Carolina. Study initiated June 17, 2019 and completed January 9, 2020.

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EXECUTIVE SUMMARY:

The effect of **Clarity® formulation (a.i. Dicamba DGA salt) + Roundup PowerMax® formulation (a.i. Glyphosate potassium salt) + Adjuvant Intact™** on the vegetative vigor of dicot (dicamba non-tolerant/glyphosate-tolerant soybean, *Glycine max*; var. AgVenture 45W7R-DU23) crops was studied in a soybean yield study. Nominal concentrations ranged from 0.00030 to 0.0048 lb ae dicamba/A and 0.00068 to 0.011 lb ae glyphosate/A in the spray tank solution. The test concentrations were analytically confirmed at all treatment levels, and nominal and measured application rates are provided in Table 3.

The study was conducted in a field located in Mississippi (silt loam, pH 5.7, organic matter 0.98%).

The study targeted application during two developmental growth stages, early vegetative growth stage (V3) and flowering reproductive stage (R1). The treatment field was divided into two equal fields with 24 replicate plots for each test; non-dicamba tolerant soybeans were planted on July 5, 2019. The test solutions were applied to the respective field on July 30, 2019 and August 9, 2019 for the vegetative growth test and the reproductive test, respectively. On 14 and 28 days after treatment (DAT) for the vegetative growth and reproductive stage test, soybean plants were measured for height and assessed for visual morphology. On November 6, 2020 (99 DAT for the vegetative growth test and 90 DAT for the reproductive test), soybean plants were harvested for determination of yield for both studies.

Comparisons across the IC25 estimates suggests similar response levels for plant height across vegetative and reproductive phase exposures and observation periods (14DAT or 28DAT). The most sensitive endpoint was based on 28DAT height in the vegetative stage, with NOAEC and IC₂₅ values of <0.00028 and 0.00107 lb ae/A dicamba, respectively.

Dry weight and survival were not tested in the two tests.

Reported visual signs of injury (VSI) included leaf cupping, epinasty of both stems and petioles, and some stunting and were readily apparent and significant (>18%) at all application rates the vegetative growth and reproductive stage study. Control plots were observed to have been exposed to dicamba as well, they all showed 5% VSI by day 14 observations in both reproductive and vegetative stage studies. VSI was evaluated using logistic regression in Excel fit to observed VSI for each test dose. No hypothesis testing was evaluated to establish NOAEC/LOAEC endpoints. Regression equations provided in Figures 3 and 4 were used to estimate the %VSI for regression based IC_x values for plant height and yield. Table 1b provides the observed (NOAECs) and estimated (IC_x) average %VSI for each height and yield endpoint for 14DAT and 28DAT.

Results Synopsis

A summary of the endpoints for height and yield are provided for dicamba (Table 1a) and glyphosate (Table 1c). Also provided in Figures 1a & 1b are the response relationships between height, VSI, yield, test concentration and evaluation time step. The average %VSI for each height and yield endpoint is provided in Table 1b. This study is scientifically sound and is classified as supplemental.

Table 1a. Summary of most sensitive parameters (lb ae/A Dicamba).

Species	Stage	Endpoint	NOAEC	EC ₀₅ /IC ₀₅	EC ₂₅ /IC ₂₅
Soybean	Vegetative Growth	14-DAT Height	0.00028	0.0000872	0.00173
		28-DAT Height	<0.00028	0.0000729	0.00107
		Yield	<0.00028	0.0000111	0.00129
	Reproductive	14-DAT Height	0.00025	0.000487	0.0022

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		28-DAT Height	<0.00025	0.000192	0.00113
		Yield	0.00025	0.00015	0.00156

¹ Significant effects at all application rates, indicating lowest test concentration did not bracket effects at the lowest concentration range, and range of application rates was inadequate to accurately determine sensitivity to the test material.

Table 1b. Summary of Estimated Average % VSI at Endpoint Concentrations provided in Table 1a. (%)

Species	Stage	Endpoint	NOAEC	EC ₀₅ /IC ₀₅	EC ₂₅ /IC ₂₅
Soybean	Vegetative Growth	14-DAT Height	35	26	52
		28-DAT Height	24	10	40
		Yield	35 (14DAT) 24 (28DAT)	9 (14DAT) <5 (28DAT)	49 (14DAT) 43 (28DAT)
	Reproductive	14-DAT Height	19	30	50
		28-DAT Height	33	15	38
		Yield	19 (14DAT) 33 (28DAT)	15 (14DAT) 11 (28DAT)	45 (14DAT) 42 (28DAT)

* Endpoints in Table 1a were used to a) provide the observed VSI at the NOAEC, and b) estimate the %VSI at height and yield IC_x endpoints using logistic regression equations fit to study reported VSI on 14-DAT and 28-DAT.

^a VSI was not assessed at the time of harvest, therefore %VSI for Yield is presented as the observed or predicted %VSI at 14DAT and 28DAT for the Yield endpoints in Table 1a.

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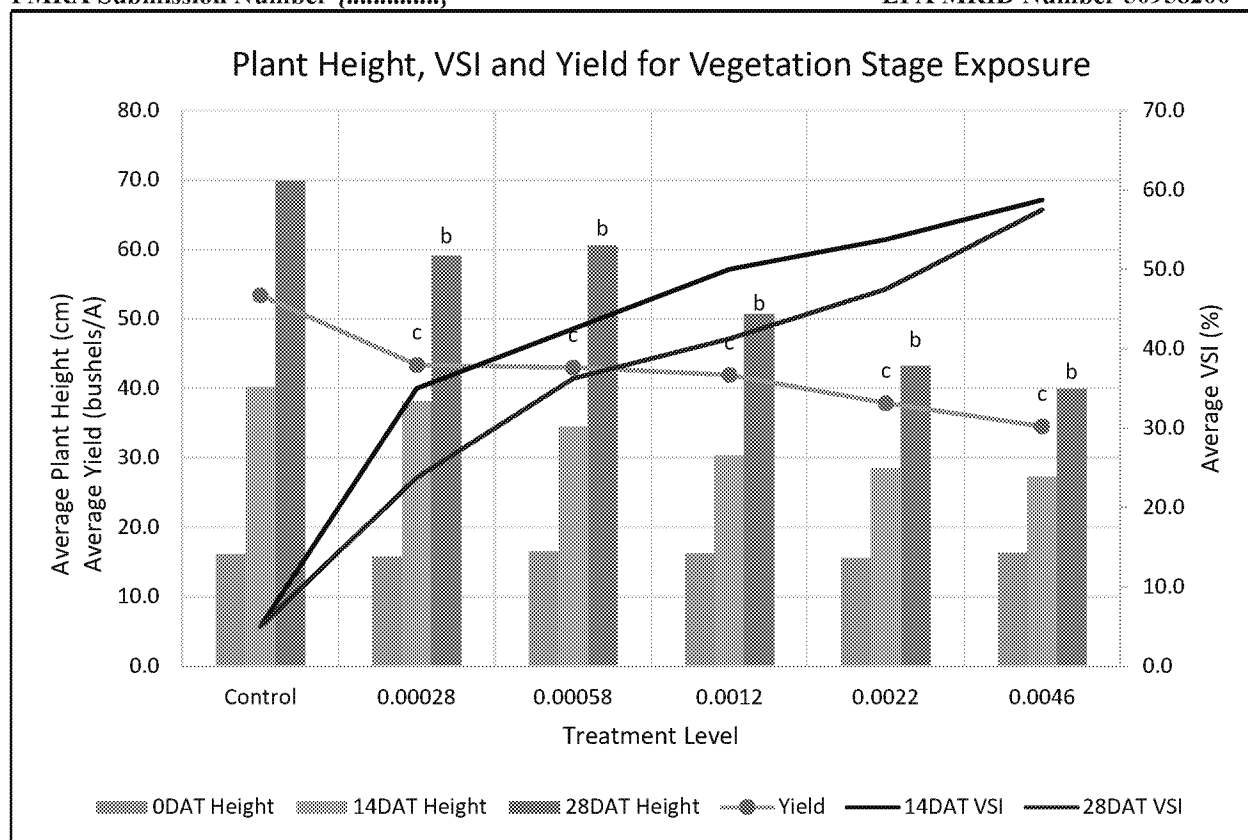


Figure 1: Relationship of plant height (Day 0, 14, 28), VSI (Day 14, 28) and yield (test termination) for the treatments applied during vegetative growth stages. Note: treatment levels with responses determined to be statistically different from the controls for day 14 height ("a"); day 28 height ("b"), and yield ("c") are indicated.

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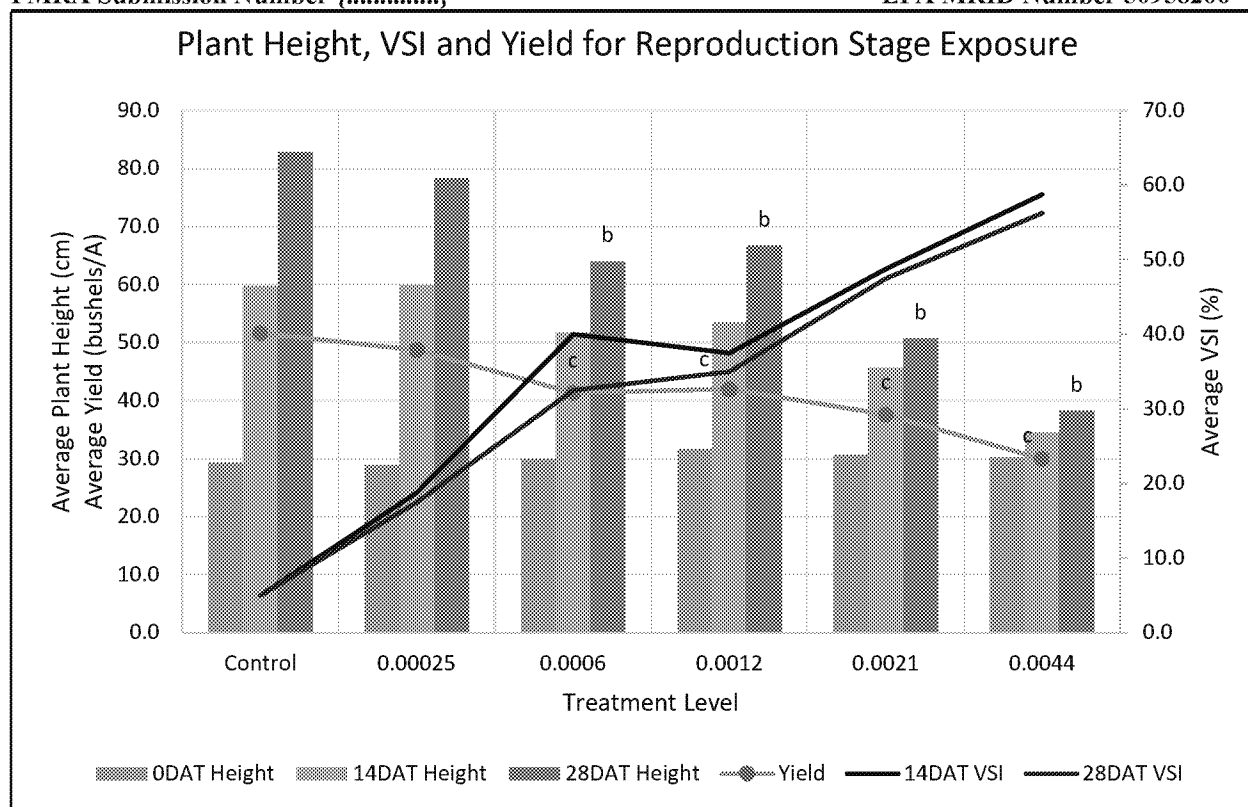


Figure 2: Relationship of plant height (Day 0, 14, 28), VSI (Day 14, 28) and yield (test termination) for the treatments applied during reproductive growth stages. Note: treatment levels with responses determined to be statistically different from the controls for day 14 height (“a”); day 28 height (“b”), and yield (“c”) are indicated.

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I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: This study was a non-guideline yield study. The reviewer evaluated the study methods according to OCSPP Guideline 850.4150: Vegetative Vigor. The following deviations were noted by the reviewer:

1. For both the vegetative growth and reproductive portions of the study, the study author measured the height of five plants “selected non-systematically” within each row of the two center rows in each replicate plot for a total of 10 plants prior to treatment, 14 DAT and 28 DAT (p. 19).

OCSPP guidance recommends that the integrity of the replicate should be maintained throughout the duration of the study. In this study, plant height was determined for ten different plants at each measurement. The reviewer suggests that this sampling method is inadequate and introduces unnecessary variability into the study results that should have been more systematically controlled.

2. Control plots were located so that “no control plot would be adjacent to a plot receiving the highest application rate” (pp. 10, 156). The study authors assume there is no potential for drift to the control plots from the other lower applications.

Likewise, the vegetative growth test field and the reproductive test fields were adjacent and separated by at least 20 ft (6 m). The prevailing wind was to the southwest, indicating the vegetative growth plots were downwind of the reproductive test plots (Appendix 5, Figure 1, p. 296). The study authors assume there is no potential for drift to the vegetative growth plots from the reproductive study spray application on August 9, 2019.

3. All controls in both vegetative and reproductive stage studies had 5% VSI observed by day 14, suggesting that they were exposed to dicamba.
4. The study author did not report inhibitions or NOAECs for height and yield data for the vegetative growth or reproductive study.
5. Significant effects were found at all application rates for both vegetative yield and reproductive height, indicating the lowest test concentration did not bracket effects at the lowest concentration range, and the range of application rates was inadequate to accurately determine sensitivity to the test material.
6. Survival of plants in each test plot was not determined. OCSPP guidance recommends measuring effects on survival as part of the vegetative vigor test. Dry weight of plants in each test plot was also not determined. OCSPP guidance recommends measuring effects on plant biomass as part of the vegetative vigor test.
7. “Soybeans will be harvested based on crop maturity relative to the plants in the control plots” (p. 162). The maturity of the soybean crop at time of harvest was not reported or described.
8. Soybean was the only species tested. OCSPP guidance recommends testing 4 monocots and 6 dicots.
9. No supplemental irrigation was applied during the study.
10. Soil percent organic carbon was not reported.
11. The study author did not provide seed supplier information and historical germination rates for the soybean varieties planted.

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12. Light intensity and humidity at the field test site were not determined. Daily observations of any moisture stress were also not reported.
13. Limits of detection (LOD) and quantification (LOQ) were not reported for HPLC-UV and UPLC-MS/MS analysis.
14. The physico-chemical properties of the test materials were not reported.
15. The AgVenture 45W7R-DU23 variety of soybean that was planted in the test plots for both the vegetative growth and reproductive study, is a non-Dicamba tolerant soybean. This variety was also selected because of its glyphosate-tolerance. It is uncertain if this genetically modified variety may have impacted dicamba effects compared to a non-genetically modified variety.

The deficiency and deviations did have an impact on the acceptability of this study.

COMPLIANCE:

Signed and dated Good Laboratory Practices (GLP), Quality Assurance, and No Data Confidentiality statements were provided. This study was conducted in compliance with U.S. EPA 40 CFR Part 160 with the following exceptions during the filed phase: field pesticide history and maintenance applications, maintenance practices (irrigation and tillage), study protocol and historical weather, GPS coordinates and slope estimates, and MF8XP combine and harvest master weighing system.

A. MATERIALS:

1. Test Material:

Clarity® formulation (a.i. Dicamba DGA salt)
Roundup PowerMax® formulation (a.i. Glyphosate potassium salt)
Intact drift reduction agent (<0.005% (v/v))

Description:

Not reported

Lot No./Batch No.:

A21638A (Batch I.D.) (Dicamba DGA salt)
934468 (Batch I.D.) (Glyphosate potassium salt)

Purity:

40.2% (w/w); 485 g/L (Dicamba)
38.9% (w/w); 527 g/L (Glyphosate)

Stability of compound under test conditions:

Measured concentration of the test material in the tank mix yielded recoveries of 82-191% (n = 10) for dicamba and 90-115% (n = 10) for glyphosate; the high recovery was confirmed to result from a sampling error and the measured test concentration was not used. Stability was not determined.
(OECD recommends chemical stability in water and light)

Storage conditions of test chemicals:

The maximum storage interval for the dicamba and glyphosate formulations was ca. 51 days at temperatures from 69 to 74.25°F (20.6 to 23.5°C).

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Table 2. Physical/chemical properties of Clarity® formulation (a.i. Dicamba DGA salt) + Roundup PowerMax® formulation (a.i. Glyphosate potassium salt)

Parameter	Values	Comments
Water solubility at 20°C	Not reported	
Vapor pressure	Not reported	
UV absorption	Not reported	
pKa	Not reported	
Kow	Not reported	

2. Test organism:

Monocotyledonous species: None.

EPA recommends four monocots in two families, including corn.

Dicotyledonous species: Soybean (*Glycine max*, Fabaceae; AgVenture 45W7R-DU23 (Dicamba non-tolerant/glyphosate-tolerant)).

EPA recommends six dicots in four families, including soybean and a root crop.

OECD recommends a minimum of three species selected for testing, at least one from each of the following categories: Category 1: ryegrass, rice, oat, wheat, and sorghum; Category 2: mustard, rape, radish, turnip, and Chinese cabbage; Category 3: vetch, mung bean, red clover, fenugreek, lettuce, and cress.

Seed source: Not reported.

Prior plant treatment/sterilization: Not reported

Historical % germination of seed: Not reported.

Seed storage, if any: Not reported.

B. STUDY DESIGN:

1. Experimental Conditions

a. Limit test: None.

b. Range-finding study: None.

c. Definitive Study

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Table 3. Nominal and Analytically Confirmed Test Application Rates (lb ac/A) for Soybean.¹

Nominal Rates		Analytically Confirmed Rates of Dicamba Adjusted for Measured Field Application Rates ² (Percent of Nominal)	Analytically Confirmed Rates of Glyphosate Adjusted for Measured Field Application Rates ² (Percent of Nominal)
as Dicamba	as Glyphosate	Vegetative Growth Stage	
0 (negative control)	0 (negative control)	0 ³	0 ³
0.00030	0.00068	0.00028 (93)	0.00069 (101)
0.00060	0.0013	0.00058 (96)	0.0016 (115)
0.0012	0.0027	0.0012 (98)	0.0026 (98)
0.0024	0.0054	0.0022 (93)	0.0053 (99)
0.0048	0.011	0.0046 (94)	0.011 (100)
		Reproductive Growth Stage	
0 (negative control)	0 (negative control)	0	0
0.00030	0.00068	0.00025 (82)	0.00062 (91)
0.00060	0.0013	0.00060 ⁴	0.0013 (91)
0.0012	0.0027	0.0012 (92)	0.0025 (91)
0.0024	0.0054	0.0021 (87)	0.0048 (90)
0.0048	0.0024	0.0044 (91)	0.010 (92)

Data obtained from Tables 2-3, pp. 31-32; Tables 21-22, pp. 50-51; and Appendix 1, Tables 3-4, pp. 96-103 in the study report.

¹ Treatments were tank-mixes of dicamba (Clarity®), glyphosate (Roundup PowerMax®), and Intact™, a drift reduction agent. Measured tank-mix concentrations for dicamba were 93-98% and 82-92% of theoretical for the vegetative and reproductive experiments, respectively. Glyphosate concentrations were 98-116% and 90-92% of theoretical for the vegetative and reproductive experiments, respectively.

² Measured tank concentrations were adjusted for measured field application rates (% of target GPA), and recoveries shown are based on analytical recoveries and field application rate recoveries and are rounded rates (DER Attachment 1).

³ Limit of quantitation (LOQ) and limit of detection (LOD) for the analytical were not reported

⁴ Sampling error, the duplicate RT2 sample set was analyzed and confirmed the error, see Reviewer's Comments.

Table 4: Experimental Parameters – Soybean Yield.

Parameters	Soybean Yield	
	Details	Remarks
		<i>Criteria</i>
Duration of the test	28 days for each experiment	Plants were exposed at two different growth stages: early vegetative (V3) and reproductive at flowering (R1).
		<i>Recommended test duration is 14-21 days.</i> <i>OECD recommends that the test be terminated no sooner than 14 days after 50 percent of the control seedlings have emerged</i>

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Number of seeds/plants/species/replicate	Soybeans were planted at a population of <i>ca.</i> 124,000 seeds/A (13,756 linear feet of row and 9 seeds per foot of row) on 38-inch row spacing.	<p><i>Ten seeds per replicate should be used.</i></p> <p><i>OECD recommends a minimum of five seeds planted in each replicate within 24 hours of incorporation of the test substance. All seeds of each species for each test should be of the same size class. The seed should not be imbibed.</i></p>
Number of plants retained after thinning	Thinning not reported.	
<u>Number of replicates</u> Control: Adjuvant control: Treated:	4 N/A 4	<p><i>Four replicates per dose should be used.</i></p> <p><i>OECD recommends a minimum of four replicates per treatment</i></p>
Number of test concentrations:	Five low dose tank-mix application (Treatments 1-5) and one negative control (Treatment 0; tank-mix water)	<p>Prepared on the day of application using a serial dilution, beginning with the highest rate and each subsequent mix being diluted by 50% of the previous volume.</p> <p><i>Five test concentrations should be used with a dose range of 2X or 3X progression</i></p> <p><i>OECD recommends three concentrations, preferably with application rates equivalent to 0.0 (control), 1.0, 10.0 and 100 mg substance per kg of oven-dried soil.</i></p>
<u>Method and interval of analytical verification</u> LOQ: LOD:	Tank-mix samples were collected and analyzed for dicamba using HPLC with UV detection and glyphosate using UPLC-MS/MS detection. Not reported Not reported	
Adjuvant (type, percentage, if used)	Intact™ (Polyethylene glycol, choline chloride, guar gum), 0.5% v/v	
<u>Test container (plot)</u> Size/Volume:	Treatment field was divided into two adjacent fields, 24 replicate plots each, for each growth test each.	Each experiment was separated from each other by a minimum of 20 ft, and the vegetative growth test field was separate from the reproductive test field by 20 ft.

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Material: (glass/polystyrene)	Each treatment area was <i>ca.</i> 29,164 ft ² and was arranged as a randomized complete block (RCB) design. Each treated replicate subplot was <i>ca.</i> 12.66 ft x 21 ft (266 ft ²). Soybeans were planted on 38-inch row spacing with the center four rows (12.66 ft width) being treated. Treatment areas were surrounded by 20 ft (6 m) buffer of soybeans.	No control plot was allowed to be adjacent to a plot receiving the highest application rate.
	Not applicable	<i>Non-porous containers should be used.</i> <i>OECD recommends that non-porous plastic or glazed pot be used.</i>
Growth facility	Soybean field located in Greenville, Mississippi	
Method/depth of seeding	Soybean seeds were planted on July 5, 2019 for both experiments at <i>ca.</i> 124,000 seeds/A (13,756 linear ft of row and 9 seeds per foot of row) on 38-inch row spacing.	Late planting was due to extremely wet planting conditions. Crop was grown and maintained according to accepted local commercial practices, except that no synthetic auxin type herbicides were applied.
Test material application Application time including the plant growth stage	Early vegetative growth: V3 Flowering reproductive stage: R1	Applicates dates were 7/30/2019 for the vegetative growth stage and 8/9/2019 for the reproductive stage.
Number of applications	Single application	
Application interval	N/A- single application for each experiment	
Method of application	The test material was applied using a backpack sprayer (CO ₂ propellant) with 4 TTI 110015 nozzles (35-45 PSI). Treatments were applied <i>ca.</i> 18 inches above the canopy, resulting in an <i>ca.</i> 6.33-ft swath. Pass times were 8.98 sec to achieve an application rate of <i>ca.</i> 14.34 gallons per acre (GPA).	
Details of soil used		Organic matter: 0.98%

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Geographic location	Greenville, Mississippi	Bulk density disturbed: 1.13 gm/cc
Depth of soil collection	Not applicable	
Soil texture	Silt loam	<i>Soil mixes containing sandy loam, loam, or clay loam soil with no greater than 2% organic matter are preferable. Glass beads, rock wool, and 100% acid washed sand are not preferred.</i>
% sand	23	
% silt	60	
% clay	17	
pH:	5.7	<i>OECD prefers the soil to be sieved (0.5 cm) to remove coarse fragments. Carbon content should not exceed 1.5% (3% organic matter). Fine particles (under 20um) makeup should be between 10 and 20%. The recommended pH is between 5.0 and 7.5.</i>
% organic carbon	Not reported	
CEC (meq/100 g)	9.2	
Moisture at 1/3 atm (%)	17.6	
Details of nutrient medium, if used	Not applicable	
<u>Watering regime and schedules</u>		No supplemental irrigation was applied during the study.
Water source/type:	None	
Volume applied:	Not applicable	
Interval of application:	Not applicable	
Method of application:	Not applicable	
		Rainfall during study is presented in Appendix 4, pp. 281-285; rainfall event >0.50 inches: 7/9/19: 0.59 in. 7/17/19: 1.15 in. 7/29/19: 0.87 in. 8/12/19: 1.39 in. 8/25/19: 0.55 in. 9/8/19: 0.86 in. 9/29/19: 0.91 in. 10/10/19: 0.72 in. 10/21/19: 0.77 in. 10/30/19: 1.03 in. Rainfall Total 7/30/2019-11/6/2019: 13.46 in.
		<i>EPA prefers that bottom watering be utilized for seedling emergence studies so that the chemical is not leached out of the soil during the test.</i>
Any pest control method/fertilization, if used	7/5/19: Boundary/s-metolachlor + metribuzin (1.22 lb ai/A) 7/22/19: Roundup/glyphosate (1.375 lb ai/A) and Zidua/pyroxasulfane (0.065 lb ai/A) 8/22/19: Dimetric/metribuzin (0.375 lb ai/A) and Dual/s-metolachlor (0.96 lb ai/A)	

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	10/2/2019: Bracket/acephate (0.97 lb ai/A) and Tundra/bifenthrin (0.094 lb ai/A)	
<u>Test conditions</u>		60% cloud cover for vegetative growth stage and 20% cloud cover for reproductive stage.
Temperature:	Vegetative growth stage: Mean 86°F Reproductive stage: Mean 87°F Over study period: Mean Monthly Max Range: 61.9-95.4°F Mean Monthly Min Range: 39.6-73.2°F	<i>EPA prefers that the cold vs warm loving plants be tested in two separate groups to optimize plant growth. OECD prefers that the temperature, humidity and light conditions be suitable for maintaining normal growth of each species for the test period.</i>
Photoperiod:	Not applicable; the study was conducted outside.	
Light intensity and quality:	Not measured	
Relative humidity:	Not measured	
<u>Reference chemical (if used)</u>	N/A	
Name:		
Concentrations:		
Other parameters, if any		
Other parameters, if any	None	

2. Observations:

Table 5: Observation Parameters – Soybean Yield.

Parameters	Vegetative Vigor	
	Details	Remarks
Parameters measured (e.g., number of germinated seeds, emerged seedlings, plant height, fresh weight or other endpoints)	Plant height Yield Visual Morphology	
Measurement technique for each parameter	Plant height was measured for 5 randomly selected plants from within each row of the 2 center rows in the treated areas of each plot for a total of 10 plants. A tape measure, ruler, or similar device was used to measure	Plots were harvest using a MF8XP small plot combine equipped with a Harvest Master weighing system. Harvest beans were weighed with a Harvest Master weighing system (non-

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	<p>from the soil surface to the tip of the newest emerging apical bud (leaf) of the main stem.</p> <p>Morphology was visually determined.</p> <p>Yield was calculated based on the actual weight of soybeans at harvest from the treated center four rows (<i>ca.</i> 266 ft²). The means from each treated replicate plot were converted to lbs/acre by multiplying by 327.69, the number of replicate plots per acre. The lbs/acre was converted to the standard bushels per acre using 60 lb/bushel at 13% moisture.</p>	<p>GLP). All plots were harvested on November 6, 2019 using a MF8XP small plot combine. Yield was calculated using a calibrated Harvest Master weighing system (p. 21).</p> <p>Following harvest, beans were left in the field, and any remaining stalks mowed.</p>
Observation intervals	Plant height and visual morphology were assessed for each treatment on the day of treatment (Day 0), or up to one day before treatment (Day -1), and at Days 14 and 28.	
Other observations, if any	N/A	
Were raw data included?	Yes	
Phytotoxicity rating system, if used	0- no effect; 100- complete effect (dead plant)	As described in Frans and Talbert (1977).

II. RESULTS and DISCUSSION:

A. INHIBITORY EFFECTS:

Survival during the study was not determined by the study author and therefore could not be analyzed by the reviewer.

Table 6a: Percent Inhibition of Survival- Vegetative Growth Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	ND
0.00060	0.0014	ND
0.0012	0.0027	ND
0.0024	0.0054	ND
0.0048	0.011	ND

ND – not determined; no data were collected as this endpoint was not analyzed.

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00028, 0.00058, 0.0012, 0.0022, and 0.0046 lb ae/A.

³ The measured, adjusted for field application rates were 0.00069, 0.0016, 0.0026, 0.0053, and 0.011 lb ae/A.

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Table 6b: Percent Inhibition of Survival - Reproductive Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	ND
0.00060	0.0014	ND
0.0012	0.0027	ND
0.0024	0.0054	ND
0.0048	0.011	ND

ND – not determined; no data were collected as this endpoint was not analyzed.

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00025, 0.00060, 0.0012, 0.0021, and 0.0044 lb ae/A.

³ The measured, adjusted for field application rates were 0.00062, 0.0013, 0.0025, 0.0048, and 0.010 lb ae/A.

When compared to the negative control, the reviewer found significant inhibitions in soybean plant height for both the vegetative growth and reproductive stages (Tables 6c and 6d). For the vegetative growth stage, significant inhibitions in soybean height were found at 0.0012 lb ae dicamba/A and 0.0027 lb ae glyphosate/A and higher, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p < 0.05$). For the reproductive stage, significant inhibitions in soybean height were found at 0.00030 lb ae dicamba/A and 0.00068 lb ae glyphosate/A, the lowest test concentration, and higher, compared to the negative control (Williams Multiple Comparison test, $p < 0.05$).

The study author did not report inhibitions in height or NOAEC values, but provided qualitative results identifying treatment levels with significant inhibitions. The reviewer's and study author's results were in agreement for the vegetative growth stage but not the reproductive stage. The study author reported significantly shorter plants at all dicamba application rates except for the 0.00030 lbs ae/A.

Table 6c: Percent Inhibition of Plant Height- Vegetative Growth Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	15
0.00060	0.0014	13
0.0012	0.0027	27*
0.0024	0.0054	38*
0.0048	0.011	42*

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00028, 0.00058, 0.0012, 0.0022, and 0.0046 lb ae/A.

³ The measured, adjusted for field application rates were 0.00069, 0.0016, 0.0026, 0.0053, and 0.011 lb ae/A.

* Statistically significant when compared to the negative control.

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Table 6d: Percent Inhibition of Plant Height- Reproductive Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	5 ^{4*}
0.00060	0.0014	22 [*]
0.0012	0.0027	19 [*]
0.0024	0.0054	38 [*]
0.0048	0.011	54 [*]

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00025, 0.00060, 0.0012, 0.0021, and 0.0044 lb ae/A.

³ The measured, adjusted for field application rates were 0.00062, 0.0013, 0.0025, 0.0048, and 0.010 lb ae/A.

⁴ The study author did not consider percent inhibition at this treatment level as statistically significant.

* Statistically significant when compared to the negative control.

When compared to the negative control, the reviewer found significant inhibitions in soybean yield for both the vegetative growth and reproductive stages (Tables 6e and 6f). For the vegetative growth stage, significant inhibitions in soybean yield were found at 0.00030 lb ae dicamba/A and 0.00068 lb ae glyphosate/A, the lowest test concentration, and higher (Williams Multiple Comparison test, $p < 0.05$). For the reproductive stage, significant inhibitions in soybean yield were found at 0.00060 lb ae dicamba/A and 0.0014 lb ae glyphosate/A and higher, compared to the negative control (Williams Multiple Comparison test, $p < 0.05$). The reviewer's and study author's results were in agreement for both the vegetative growth and reproductive stages.

Table 6e: Percent Inhibition of Plant Yield- Vegetative Growth Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	19 [*]
0.00060	0.0014	20 [*]
0.0012	0.0027	21 [*]
0.0024	0.0054	29 [*]
0.0048	0.011	35 [*]

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00028, 0.00058, 0.0012, 0.0022, and 0.0046 lb ae/A.

³ The measured, adjusted for field application rates were 0.00069, 0.0016, 0.0026, 0.0053, and 0.011 lb ae/A.

* Statistically significant when compared to the negative control.

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Table 6f: Percent Inhibition of Plant Yield- Reproductive Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	6
0.00060	0.0014	20*
0.0012	0.0027	19*
0.0024	0.0054	27*
0.0048	0.011	42*

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00025, 0.00060, 0.0012, 0.0021, and 0.0044 lb ae/A.

³ The measured, adjusted for field application rates were 0.00062, 0.0013, 0.0025, 0.0048, and 0.010 lb ae/A.

* Statistically significant when compared to the negative control.

Dry weight during the study was not determined by the study author and therefore could not be analyzed by the reviewer.

Table 6g: Percent Inhibition of Dry Weight- Vegetative Growth Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	ND
0.00060	0.0014	ND
0.0012	0.0027	ND
0.0024	0.0054	ND
0.0048	0.011	ND

ND – not determined; no data were collected as this endpoint was not analyzed.

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00028, 0.00058, 0.0012, 0.0022, and 0.0046 lb ae/A.

³ The measured, adjusted for field application rates were 0.00069, 0.0016, 0.0026, 0.0053, and 0.011 lb ae/A.

Table 6h: Percent Inhibition of Dry Weight - Reproductive Stage.

Nominal Rate lb ae/A		Percent Inhibition ¹
Clarity® (a.i. Dicamba) ²	Roundup PowerMax® (a.i. Glyphosate) ³	Soybean
0.00030	0.00068	ND
0.00060	0.0014	ND
0.0012	0.0027	ND
0.0024	0.0054	ND
0.0048	0.011	ND

ND – not determined; no data were collected as this endpoint was not analyzed.

¹ Treatment groups compared to the negative control

² The measured, adjusted for field application rates were 0.00025, 0.00060, 0.0012, 0.0021, and 0.0044 lb ae/A.

³ The measured, adjusted for field application rates were 0.00062, 0.0013, 0.0025, 0.0048, and 0.010 lb ae/A.

The most sensitive dicot was soybean, based on height in the vegetative stage, with a NOAEC and an IC₂₅ value of 0.00058 and 0.00107 lb ae/A Dicamba, respectively (corresponding to a NOAEC and IC₂₅ of

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0.0016 and 0.00259 lb ae/A Glyphosate). The IC₀₅, IC₅₀, and/or corresponding 95% confidence intervals were outside of the range of tested concentrations; therefore, these soybean results should be interpreted with caution.

The phytotoxic symptoms noted included leaf cupping and leaf wrinkling and were found at moderate levels in soybean plants in both the vegetative growth study and the reproductive study. Phytotoxic symptoms showed a dose-dependent response in both studies.

B. REPORTED STATISTICS:

To prepare the data for statistical analyses, a blocking factor variable was created by extracting the first number of the treatment plot, which resulted in all records being assigned to one of five grouping blocks. Each grouping block effectively contains 6 plots, one for each level of the application rate. This procedure was performed to account for the randomized block design of the experimental plot in the field trials.

For each experiment, a concentration-response model was used to estimate an EC₂₅ for plant height and yield if the overall test for a variable and time-point was significant ($\alpha=0.05$). Application Rate Curve Modeling analysis was conducted by transforming the dicamba application rate using log (dicamba application rate (lb ae/A) +0.0001). Bivariate plots with dicamba application rates and the crop response variable in the x and y axis, respectively, were evaluated and a logistic equation was fit to the data.

To compare differences in yield and mean plant height between treatments, an ordinary linear square regression (OLS) model was fitted to each crop stage. F-statistics and p-values were generated for each model using ANOVA. When ANOVA indicated statistically significant differences between the treatment levels ($\alpha=0.05$) and goodness of fit indicators suggested that the model provided an adequate fit to the data, differences between the control and all treatment levels were evaluated using the Dunnett's test. Visual injury ratings were analysed using the Friedman's test. When significant differences between treatments were found, the Nemenyi test was used to conduct post-hoc, pairwise comparisons between the control plots and the different dicamba application rates. All statistical analyses were performed using R statistical software (R Core Team, 2019c).

Table 7a: Effect of Clarity® (a.i. Dicamba DGA salt) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Vegetative Growth Stage.

Species	Results summary for height (lb ae/A Dicamba)									
	height (cm)	NOAEC	EC ₀₅	95% CI	EC ₂₅	95% CI	EC ₅₀	95% CI	slope	95%CI
Soybean	40-70	ND	NC	N/A	0.0011	ND	ND	ND	N/A	N/A

ND = Not determined. N/A = Not applicable. N/C = Not calculable.

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Table 7b: Effect of Clarity® (a.i. Dicamba DGA salt) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Reproductive Stage.

Species	Results summary for height (lb ae/A Dicamba)									
	height (cm)	NOAEC	EC ₀₅	95% CI	EC ₂₅	95% CI	EC ₅₀	95% CI	slope	95% CI
Soybean	38-83	ND	NC	N/A	0.0012	ND	ND	ND	N/A	N/A

ND = Not determined. N/A = Not applicable. N/C = Not calculable.

Table 7c: Effect of Clarity® (a.i. Dicamba DGA salt) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Vegetative Growth Stage.

Species	Results summary for yield (lb ae/A Dicamba)									
	yield (kg/ha)	NOAEC	EC ₀₅	95% CI	EC ₂₅	95% CI	EC ₅₀	95% CI	slope	95% CI
Soybean	2348-3633*	ND	NC	N/A	0.0014	ND	NC	N/A	N/A	N/A

ND = Not determined. N/A = Not applicable. N/C = Not calculable.

* Yield data were calculated accounting for percent soil moisture.

Table 7d: Effect of Clarity® (a.i. Dicamba DGA salt) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Reproductive Growth Stage.

Species	Results summary for yield (lb ae/A Dicamba)									
	yield (kg/ha)	NOAEC	EC ₀₅	95% CI	EC ₂₅	95% CI	EC ₅₀	95% CI	slope	95% CI
Soybean	2027-3504*	ND	NC	N/A	0.0017	ND	NC	N/A	N/A	N/A

ND = Not determined. N/A = Not applicable. N/C = Not calculable.

* Yield data were calculated accounting for percent soil moisture.

Table 7e: Effect of Clarity® (a.i. Dicamba DGA salt) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Vegetative Growth Stage.

Species	Results summary for survival (lb ae/A Dicamba)									
	%	NOAEC	EC ₀₅	95% CI	EC ₂₅	95% CI	EC ₅₀	95% CI	slope	95% CI
Soybean	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A

ND = Not determined. N/A = Not applicable. N/C = Not calculable.

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Table 7f: Effect of Clarity® (a.i. Dicamba DGA salt) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Reproductive Growth Stage.

Species	Results summary for survival (lb ae/A Dicamba)									
	%	NOAEC	EC ₀₅	95% CI	EC ₂₅	95% CI	EC ₅₀	95% CI	slope	95% CI
Soybean	ND	ND	ND	N/A	ND	N/A	ND	N/A	N/A	N/A

ND = Not determined. N/A = Not applicable. N/C = Not calculable.

* Yield data were calculated accounting for percent soil moisture.

28-Day Mean Visual Injury Rating			
Nominal Rate lb ae/A		Vegetative Growth Stage (%)	Reproductive Stage (%)
Clarity® (a.i. Dicamba) ¹	Roundup PowerMax® (a.i. Glyphosate) ²		
0 (negative control)	0 (negative control)	5 ± 0.0	5 ± 0.0
0.00030	0.00068	24 ± 4.8	18 ± 2.9
0.00060	0.0014	36 ± 2.5	33 ± 2.9
0.0012	0.0027	41 ± 6.3	35 ± 0.0
0.0024	0.0054	48 ± 2.9*	48 ± 2.9*
0.0048	0.011	58 ± 2.9*	56 ± 2.5*

¹ The measured, adjusted for field application rates were 0.00028, 0.00058, 0.0012, 0.0022, and 0.0046 lb ae dicamba/A and 0.00069, 0.0016, 0.0026, 0.0053, and 0.011 lb ae glyphosate/A for the vegetative growth stage.

² The measured, adjusted for field application rates were 0.00025, 0.00060, 0.0012, 0.0021, and 0.0044 lb ae dicamba/A and 0.00062, 0.0012, 0.0025, 0.0048, and 0.010 lb ae glyphosate/A for the reproductive stage.

* Reported by the study author to be significantly greater than the control, according to the Nemenyi test.

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C. VERIFICATION OF STATISTICAL RESULTS BY THE REVIEWER:

All analyses were conducted comparing treated to the negative control. These analyses were conducted using CETIS version 1.9.5.3 with database backend settings implemented by EFED on 7/25/2017. Data for each endpoint were tested to determine if their distributions were normal and if their variances were homogeneous using Shapiro-Wilk's and Levene's tests, respectively. Data that satisfied these assumptions were subjected to Dunnett's and William's tests, and data that did not satisfy these assumptions were subjected to the non-parametric Mann-Whitney U and Jonckheere's tests. Nonlinear (height and yield) regression models were used to interpret EC/ICx values. Adjusted, measured concentrations were used for all statistical analyses.

Table 8a: Effect of Clarity® (a.i. Dicamba DGA) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Vegetative Growth Stage.

Species	Results summary for height (lb ae/A Dicamba)									
	height (cm)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
Soybean	40.2-69.8	0.00058	0.0000729	N/A-0.000222	0.00107	0.000725-0.00152	0.0069	0.00372-0.0128	N/A	N/A
	Results summary for height (lb ae/A Glyphosate)									
	height (cm)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
	40.2-69.8	0.0016	0.000182	N/A-0.000562	0.00259	0.00175-0.0037	0.0164	0.00873-0.0309	N/A	N/A

N/A = Not applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

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Table 8c: Effect of Clarity® (a.i. Dicamba DGA) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Vegetative Growth Stage.

Species	Results summary for yield (lb ae/A Dicamba)									
	yield (kg/ha)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
Soybean	2320-3590	<0.00028	0.0000111	N/A-0.000118	0.00129	0.000705-0.00225	0.0353	0.00441-0.282	N/A	N/A
	Results summary for yield (lb ae/A Glyphosate)									
	yield (kg/ha)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
	2320-3590	<0.00069	0.0000312	N/A-0.000303	0.00313	0.00175-0.00535	0.0769	0.0106-0.56	N/A	N/A

N/A = Not applicable.

Table 9a: Effect of Clarity® (a.i. Dicamba DGA) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Reproductive Stage.

Species	Results summary for height (lb ae/A Dicamba)									
	height (cm)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
Soybean	38.2-82.8	<0.00025	0.000192	7.03E-05-0.000319	0.00113	0.000921-0.00137	0.00388	0.00312-0.00482	N/A	N/A
	Results summary for height (lb ae/A Glyphosate)									
	height (cm)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
	38.2-82.8	<0.00062	0.000411	0.000156-0.000681	0.00248	0.00203-0.00298	0.00865	0.007-0.0107	N/A	N/A

N/A = Not applicable.

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Table 9b: Effect of Clarity® (a.i. Dicamba DGA) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Reproductive Stage.

N/A = Not applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

Table 9c: Effect of Clarity® (a.i. Dicamba DGA) + Roundup PowerMax® (a.i. Glyphosate potassium salt) on 28-Day Soybean Yield- Reproductive Stage.

Species	Results summary for yield (lb ae/A Dicamba)									
	yield (kg/ha)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
Soybean	2020-3470	0.00025	0.00015	4.56E-05-0.000284	0.00156	0.00125-0.00191	0.00793	0.00519-0.0121	N/A	N/A
	Results summary for yield (lb ae/A Glyphosate)									
	yield (kg/ha)	NOAEC	IC ₀₅	95% CI	IC ₂₅	95% CI	IC ₅₀	95% CI	slope	95% CI
	2020-3470	0.00062	0.000325	9.63E-05-0.000622	0.00346	0.00277-0.00426	0.0179	0.0117-0.0274	N/A	N/A

N/A = Not applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

Evaluation of Visual Signs of Injury:

VSI was evaluated using logistic regression in Excel fit to observed VSI for each test dose. No hypothesis testing was evaluated to establish NOAEC/LOAEC endpoints. Regression equations provided in Figures 3 and 4 were used to estimate the %VSI for regression based IC_x values for plant height and yield. See Table 1b in the executive summary for the results of these estimation procedures.

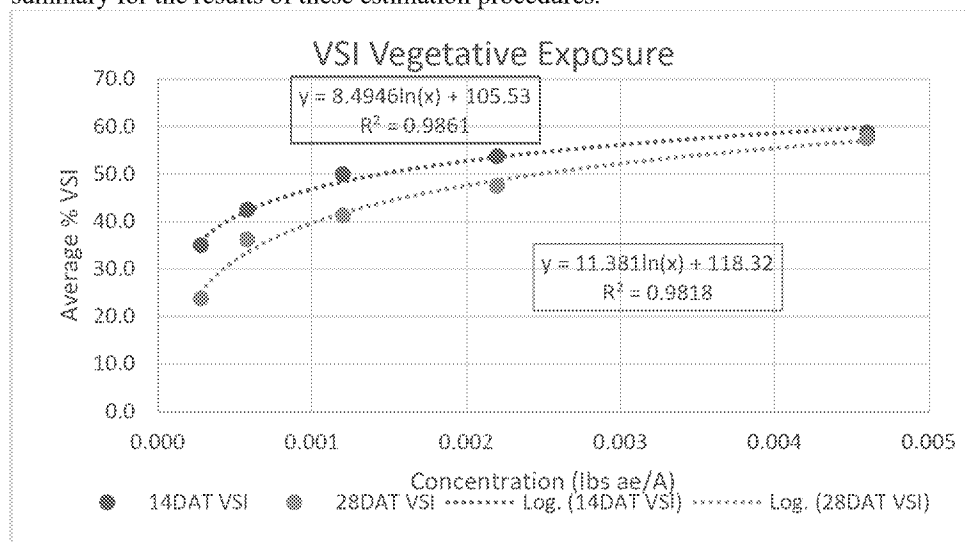


Figure 3. Logistic regression of %VSI for 14DAT and 28DAT observations of %VSI after a vegetative growth stage exposure.

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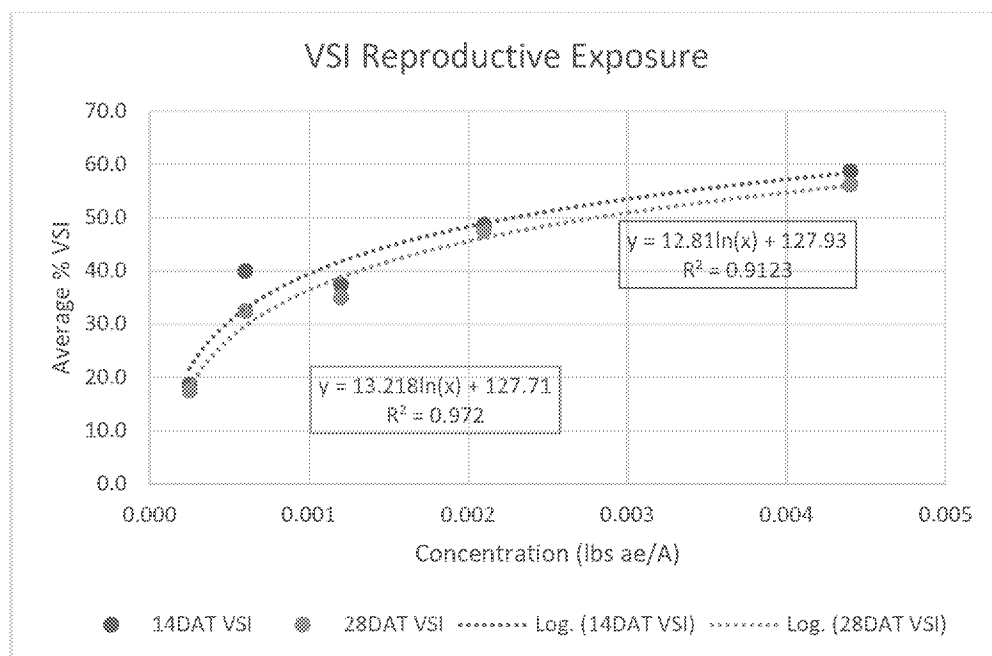


Figure 4. Logistic regression of %VSI for 14DAT and 28DAT observations of %VSI after a reproductive growth stage exposure.

D. STUDY DEFICIENCIES:

See discussion provided above

E. REVIEWER'S COMMENTS:

The reproductive stage with a NOAEC and EC₂₅ value for dicamba of <0.00028 and 0.00107 lb ae/A were the most sensitive measures of growth and reproduction overall (the study author did not report NOAEC values or endpoints in terms of glyphosate). Significant effects were observed at all application rates.

Differences between the study author and reviewer's results resulted from differences in statistical methods (hypothesis tests) and the study author analyzing nominal test concentrations while the reviewer analyzed measured test concentrations.

Application dates for the vegetative growth and reproductive stages were July 30, 2019 and August 9, 2019, respectively. The experimental completion date was November 6, 2019.

F. CONCLUSIONS:

See executive summary for reviewer's conclusions.

This study is scientifically sound and is classified as supplemental.

Data Evaluation Record on the Toxicity of Dicamba DGA salt and Glyphosate potassium salt to Terrestrial Vascular Plants: Soybean Yield

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III. REFERENCES:

U.S. Environmental Protection Agency. 2012. Series 850-Ecological Effects Test Guidelines, OCSP Number 850.4150: Vegetative Vigor.

ATTACHMENT 1. OUTPUT OF REVIEWER'S STATISTICAL VERIFICATION



128931+_50958206
_CETIS_3-31-20.pdf

ATTACHMENT 2. APPLICATION RATES, CONVERSIONS AND RAW DATA EXCEL FILE



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%2019-077%20Heigh

CETIS Summary Report

Report Date: 31 Mar-20 19:33 (p 1 of 2)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Batch ID: 04-0546-4430	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 09 Aug-19	Protocol: OCSP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 89d 0h	Taxon:	Source: Age: R1
Sample ID: 02-2590-8469	Code: 50958206 direpr	Project:
Sample Date: 09 Aug-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Reproductive stage (R1)

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓ NOEL	LOEL	TOEL	TU	PMSD	S
10-0369-9682	Height	Dunnett Multiple Comparison Test	0.00025	0.0006	0.0003873		6.86%	1
01-7631-3880	Height	Williams Multiple Comparison Test	✓ <0.00025	0.00025	n/a		5.32%	1
07-1850-7769	Weight	Dunnett Multiple Comparison Test	0.00025	0.0006	0.0003873		7.67%	1
10-7288-0139	Weight	Williams Multiple Comparison Test	0.00025	0.0006	0.0003873		5.95%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	lbs ae/A	95% LCL	95% UCL	TU	S
20-9475-5438	Height	NLR: 3P Cum Log-Normal (Probit)	IC5	0.000192	7.03E-05	0.000319		1
			IC10	0.000372	0.000239	0.000522		
			✓ IC25	0.00113	0.000921	0.00137		
			✓ IC50	0.00388	0.00312	0.00482		
11-8407-7761	Weight	NLR: 3P Cum Log-Normal (Probit)	✓ IC5	0.00015	4.56E-05	0.000284		1
			✓ IC10	0.00036	0.000211	0.000547		
			IC25	0.00156	0.00125	0.00191		
			IC50	0.00793	0.00519	0.0121		

Height Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	82.8	78	87.5	80	87	1.49	2.99	3.61%	0.00%
0.00025		4	78.5	75.5	81.5	76	80	0.957	1.91	2.44%	5.14%
0.0006		4	64.2	59.9	68.6	61	67	1.38	2.75	4.29%	22.36%
0.0012		4	66.8	60.6	72.9	63	72	1.93	3.86	5.79%	19.34%
0.0021		4	51	42.7	59.3	47	58	2.61	5.23	10.25%	38.37%
0.0044		4	38.2	35	41.5	36	41	1.03	2.06	5.39%	53.78%

Weight Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	3470	3110	3830	3140	3610	112	224	6.46%	0.00%
0.00025		4	3280	3080	3480	3120	3390	62	124	3.78%	5.51%
0.0006		4	2780	2590	2970	2650	2940	59.8	120	4.30%	19.90%
0.0012		4	2820	2580	3070	2740	3050	76.4	153	5.41%	18.63%
0.0021		4	2530	2220	2830	2280	2750	96	192	7.59%	27.16%
0.0044		4	2020	1890	2150	1900	2080	41	81.9	4.06%	41.93%

CETIS Summary Report

Report Date: 31 Mar-20 19:33 (p 2 of 2)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Height Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	82	80	87	82
0.00025		76	78	80	80
0.0006		61	63	66	67
0.0012		72	65	63	67
0.0021		52	47	58	47
0.0044		38	36	38	41

Weight Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	3140	3540	3610	3590
0.00025		3240	3370	3120	3390
0.0006		2770	2760	2650	2940
0.0012		3050	2740	2750	2760
0.0021		2540	2280	2750	2550
0.0044		2050	1900	2040	2080

CETIS Summary Report

Report Date: 31 Mar-20 23:17 (p 1 of 2)

Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3

Sample ID: 07-1673-7711	Code: 50958206 diveg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	✓ NOEL	LOEL	TOEL	TU	PMSD	S
18-4268-9682	Height	Jonckheere-Terpstra Step-Down Test	0.00058	0.0012	0.0008343	n/a	n/a	1
08-8060-5534	Height	Mann-Whitney U Two-Sample Test	0.00058	0.0012	0.0008343		10.8%	1
07-5460-9502	Weight	Dunnett Multiple Comparison Test	✓ <0.00028	0.00028	n/a		13.9%	1
11-3012-8646	Weight	Williams Multiple Comparison Test	✓ <0.00028	0.00028	n/a		10.8%	1

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	✓ Level	lbs ae/A	95% LCL	95% UCL	TU	S
00-6015-2453	Height	NLR: 3P Cum Log-Normal (Probit)	IC5	0.0000729	n/a	0.000222		1
			IC10	0.000199	0.0000618	0.00042		
			✓ IC25	0.00107	0.000725	0.00152		
			✓ IC50	0.0069	0.00372	0.0128		
04-0035-7898	Weight	NLR: 3P Cum Log-Normal (Probit)	✓ IC5	0.0000111	n/a	0.000118		1
			✓ IC10	0.0000657	2.94E-06	0.000342		
			IC25	0.00129	0.000705	0.00225		
			IC50	0.0353	0.00441	0.282		

Height Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	69.8	62.5	77	63	73	2.29	4.57	6.56%	0.00%
0.00028		4	59	44.1	73.9	45	64	4.67	9.35	15.84%	15.41%
0.00058		4	60.5	49.1	71.9	51	66	3.57	7.14	11.80%	13.26%
0.0012		4	51	48.4	53.6	49	53	0.816	1.63	3.20%	26.88%
0.0022		4	43.2	37.2	49.3	38	46	1.89	3.77	8.73%	37.99%
0.0046		4	40.2	37	43.5	38	42	1.03	2.06	5.12%	42.29%

Weight Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	3590	3300	3890	3450	3870	93	186	5.18%	0.00%
0.00028		4	2920	2340	3490	2380	3170	180	359	12.32%	18.86%
0.00058		4	2890	2170	3620	2340	3400	227	454	15.69%	19.50%
0.0012		4	2820	2600	3040	2710	3020	68.2	136	4.84%	21.49%
0.0022		4	2550	2160	2940	2200	2770	123	245	9.63%	29.08%
0.0046		4	2320	1910	2740	2000	2630	130	260	11.21%	35.36%

CETIS Summary Report

Report Date: 31 Mar-20 23:17 (p 2 of 2)
Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Height Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	63	72	73	71
0.00028		64	64	45	63
0.00058		51	59	66	66
0.0012		49	53	51	51
0.0022		46	43	38	46
0.0046		42	38	39	42

Weight Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	3450	3520	3870	3530
0.00028		3030	3170	2380	3090
0.00058		2340	2760	3400	3080
0.0012		2770	2710	3020	2780
0.0022		2770	2570	2200	2660
0.0046		2300	2370	2000	2630

CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 1 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)				Stone Environmental, Inc.	
Analysis ID:	10-0369-9682	Endpoint:	Height	CETIS Version:	CETISv1.9.5
Analyzed:	31 Mar-20 19:31	Analysis:	Parametric-Control vs Treatments	Status Level:	1
Batch ID:	04-0546-4430	Test Type:	Vegetative Vigor Tier II	Analyst:	
Start Date:	09 Aug-19	Protocol:	OCSPP 850.4150 Plant Vegetative Vigor	Diluent:	
Ending Date:	06 Nov-19	Species:	Glycine max	Brine:	
Test Length:	89d 0h	Taxon:		Source:	Age: R1

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	0.00025	0.0006	0.0003873		6.86%

Dunnett Multiple Comparison Test

Control	vs	Conc-lbs ae/	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00025	1.8	2.41	5.67	6	CDF	0.1444	Non-Significant Effect
		0.0006*	7.85	2.41	5.67	6	CDF	2.8E-05	Significant Effect
		0.0012*	6.79	2.41	5.67	6	CDF	3.2E-05	Significant Effect
		0.0021*	13.5	2.41	5.67	6	CDF	2.7E-05	Significant Effect
		0.0044*	18.9	2.41	5.67	6	CDF	2.7E-05	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.37	2.8	0.2812	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5601.83	1120.37	5	101	<1.0E-37	Significant Effect
Error	200	11.1111	18			
Total	5801.83		23			

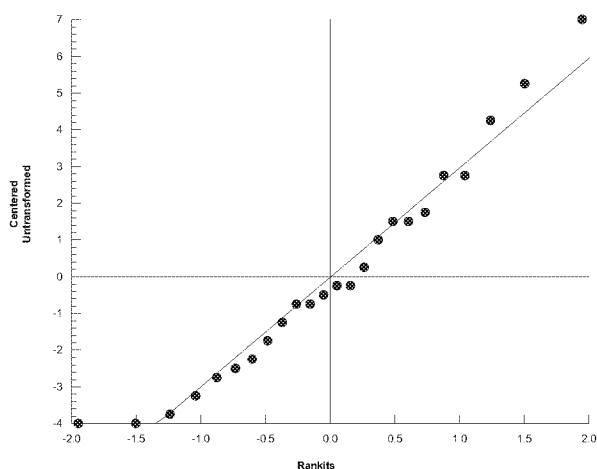
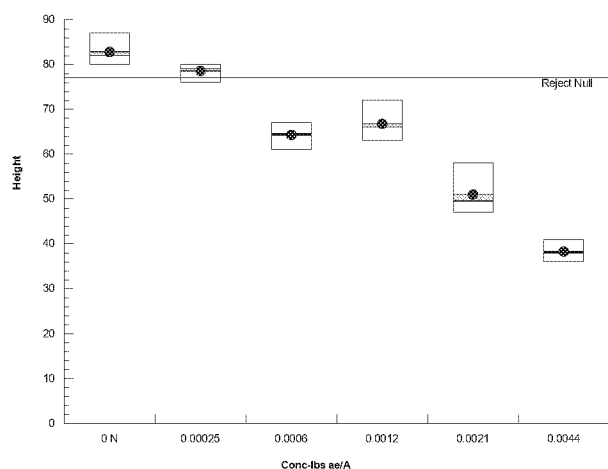
ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	3.92	15.1	0.5606	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.954	0.884	0.3347	Normal Distribution

Height Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	82.8	78	87.5	82	80	87	1.49	3.61%	0.00%
0.00025		4	78.5	75.5	81.5	79	76	80	0.957	2.44%	5.14%
0.0006		4	64.2	59.9	68.6	64.5	61	67	1.38	4.29%	22.36%
0.0012		4	66.8	60.6	72.9	66	63	72	1.93	5.79%	19.34%
0.0021		4	51	42.7	59.3	49.5	47	58	2.61	10.25%	38.37%
0.0044		4	38.2	35	41.5	38	36	41	1.03	5.39%	53.78%

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 2 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)				Stone Environmental, Inc.	
Analysis ID:	01-7631-3880	Endpoint:	Height	CETIS Version:	CETISv1.9.5
Analyzed:	31 Mar-20 19:32	Analysis:	Parametric-Control vs Ord.Treatments	Status Level:	1
Batch ID:	04-0546-4430	Test Type:	Vegetative Vigor Tier II	Analyst:	
Start Date:	09 Aug-19	Protocol:	OCSPP 850.4150 Plant Vegetative Vigor	Diluent:	
Ending Date:	06 Nov-19	Species:	Glycine max	Brine:	
Test Length:	89d 0h	Taxon:		Source:	Age: R1

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	<0.00025	0.00025	n/a		5.32%

Williams Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00025*	1.8	1.73	4.09	6	CDF	<0.05	Significant Effect
		0.0006*	7.85	1.82	4.29	6	CDF	<0.05	Significant Effect
		0.0012*	7.32	1.85	4.35	6	CDF	<0.05	Significant Effect
		0.0021*	13.5	1.86	4.38	6	CDF	<0.05	Significant Effect
		0.0044*	18.9	1.87	4.4	6	CDF	<0.05	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.37	2.8	0.2812	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5601.83	1120.37	5	101	<1.0E-37	Significant Effect
Error	200	11.1111	18			
Total	5801.83		23			

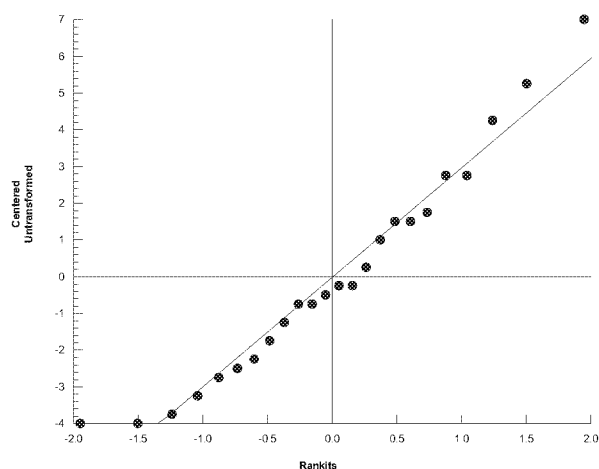
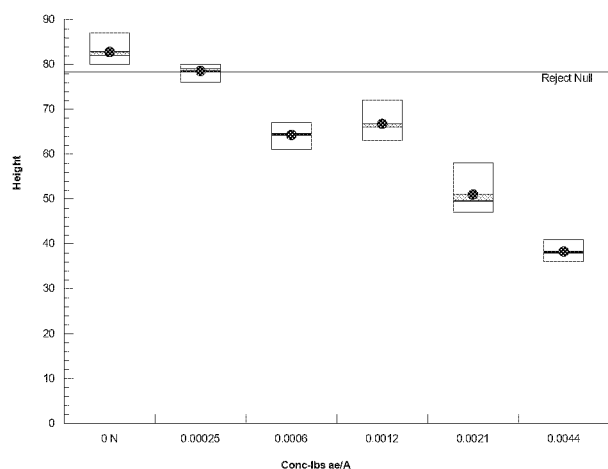
ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	3.92	15.1	0.5606	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.954	0.884	0.3347	Normal Distribution

Height Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	82.8	78	87.5	82	80	87	1.49	3.61%	0.00%
0.00025		4	78.5	75.5	81.5	79	76	80	0.957	2.44%	5.14%
0.0006		4	64.2	59.9	68.6	64.5	61	67	1.38	4.29%	22.36%
0.0012		4	66.8	60.6	72.9	66	63	72	1.93	5.79%	19.34%
0.0021		4	51	42.7	59.3	49.5	47	58	2.61	10.25%	38.37%
0.0044		4	38.2	35	41.5	38	36	41	1.03	5.39%	53.78%

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 3 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 07-1850-7769	Endpoint: Weight	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:31	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 04-0546-4430	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 09 Aug-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 89d 0h	Taxon:	Source: Age: R1

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	0.00025	0.0006	0.0003873		7.67%

Dunnett Multiple Comparison Test

Control	vs	Conc-lbs ae/	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00025	1.73	2.41	266	6	CDF	0.1625	Non-Significant Effect
		0.0006*	6.24	2.41	266	6	CDF	4.2E-05	Significant Effect
		0.0012*	5.84	2.41	266	6	CDF	6.2E-05	Significant Effect
		0.0021*	8.52	2.41	266	6	CDF	2.7E-05	Significant Effect
		0.0044*	13.2	2.41	266	6	CDF	2.7E-05	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.41	2.8	0.2467	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5473960	1094790	5	44.7	<1.0E-37	Significant Effect
Error	440852	24491.8	18			
Total	5914810		23			

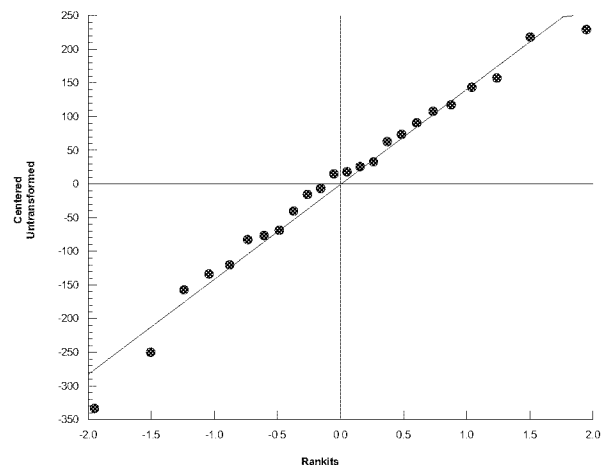
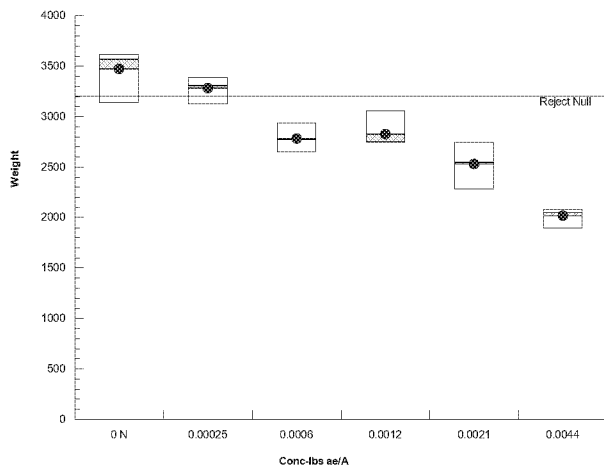
ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	3.23	15.1	0.6649	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.977	0.884	0.8342	Normal Distribution

Weight Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	3470	3110	3830	3570	3140	3610	112	6.46%	0.00%
0.00025		4	3280	3080	3480	3300	3120	3390	62	3.78%	5.51%
0.0006		4	2780	2590	2970	2770	2650	2940	59.8	4.30%	19.90%
0.0012		4	2820	2580	3070	2750	2740	3050	76.4	5.41%	18.63%
0.0021		4	2530	2220	2830	2540	2280	2750	96	7.59%	27.16%
0.0044		4	2020	1890	2150	2040	1900	2080	41	4.06%	41.93%

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 4 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 10-7288-0139	Endpoint: Weight	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:32	Analysis: Parametric-Control vs Ord.Treatments	Status Level: 1
Batch ID: 04-0546-4430	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 09 Aug-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 89d 0h	Taxon:	Source:
		Age: R1

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	0.00025	0.0006	0.0003873		5.95%

Williams Multiple Comparison Test

Control	vs	Conc-lbs ae/	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00025	1.73	1.73	192	6	CDF	>0.05	Non-Significant Effect
		0.0006*	6.24	1.82	201	6	CDF	<0.05	Significant Effect
		0.0012*	6.04	1.85	204	6	CDF	<0.05	Significant Effect
		0.0021*	8.52	1.86	206	6	CDF	<0.05	Significant Effect
		0.0044*	13.2	1.87	207	6	CDF	<0.05	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.41	2.8	0.2467	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5473960	1094790	5	44.7	<1.0E-37	Significant Effect
Error	440852	24491.8	18			
Total	5914810		23			

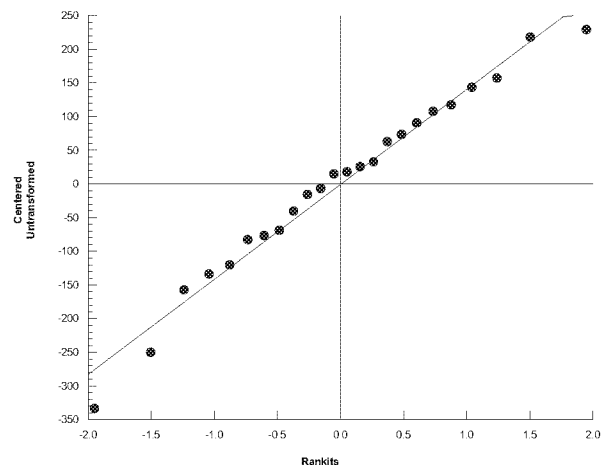
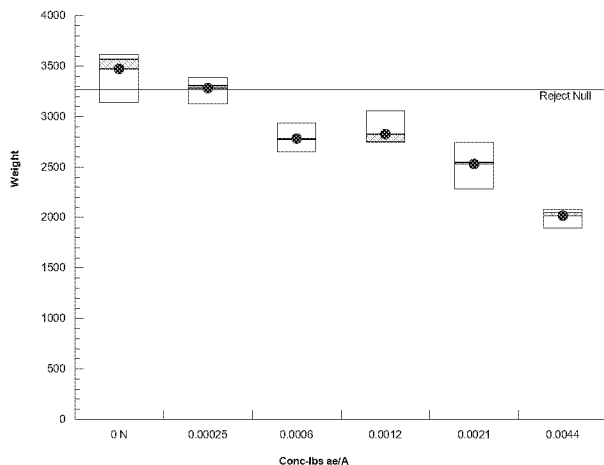
ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	3.23	15.1	0.6649	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.977	0.884	0.8342	Normal Distribution

Weight Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	3470	3110	3830	3570	3140	3610	112	6.46%	0.00%
0.00025		4	3280	3080	3480	3300	3120	3390	62	3.78%	5.51%
0.0006		4	2780	2590	2970	2770	2650	2940	59.8	4.30%	19.90%
0.0012		4	2820	2580	3070	2750	2740	3050	76.4	5.41%	18.63%
0.0021		4	2530	2220	2830	2540	2280	2750	96	7.59%	27.16%
0.0044		4	2020	1890	2150	2040	1900	2080	41	4.06%	41.93%

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 1 of 4)
 Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 20-9475-5438	Endpoint: Height	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:31	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 04-0546-4430	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 09 Aug-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 89d 0h	Taxon:	Source: Age: R1

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Cum Log-Normal (Probit): $\mu = \alpha [1 - \Phi[\log[x/\delta]/\gamma]]$	Normal [$\omega=1$]	Off [$\mu^*=\mu$]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision($\alpha:5\%$)
5	-36.3	79.7	82.1	0.9108	5.62%	82.5	Yes	8.17	0.0012	Significant Lack of Fit

Point Estimates

Level	lbs ae/A	95% LCL	95% UCL
IC5	0.000192	7.03E-05	0.000319
IC10	0.000372	0.000239	0.000522
IC25	0.00113	0.000921	0.00137
IC50	0.00388	0.00312	0.00482

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision($\alpha:5\%$)
α	82.5	2.23	77.9	87.2	37	<1.0E-37	Significant Parameter
γ	1.83	0.224	1.36	2.29	8.16	<1.0E-37	Significant Parameter
δ	0.00388	0.000448	0.00295	0.00481	8.65	<1.0E-37	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision($\alpha:5\%$)
Model	102000	34100	3	1520	<1.0E-37	Significant
Lack of Fit	272	90.8	3	8.17	0.0012	Significant
Pure Error	200	11.1	18			
Residual	472	22.5	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision($\alpha:5\%$)
Outlier	Grubbs Extreme Value Test	2.42	2.8	0.2392	No Outliers Detected
Variance	Bartlett Equality of Variance Test	3.92	11.1	0.5606	Equal Variances
	Mod Levene Equality of Variance	1.01	2.77	0.4398	Equal Variances
Distribution	Anderson-Darling A2 Normality Test	0.174	2.49	0.9821	Normal Distribution
	Shapiro-Wilk W Normality Test	0.987	0.917	0.9856	Normal Distribution

Height Summary

Conc-lbs ae/A	Code	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	82.8	80	87	1.49	2.99	3.61%	0.0%
0.00025		4	78.5	76	80	0.957	1.91	2.44%	5.14%
0.0006		4	64.2	61	67	1.38	2.75	4.29%	22.4%
0.0012		4	66.8	63	72	1.93	3.86	5.79%	19.3%
0.0021		4	51	47	58	2.61	5.23	10.30%	38.4%
0.0044		4	38.2	36	41	1.03	2.06	5.39%	53.8%

CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 2 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

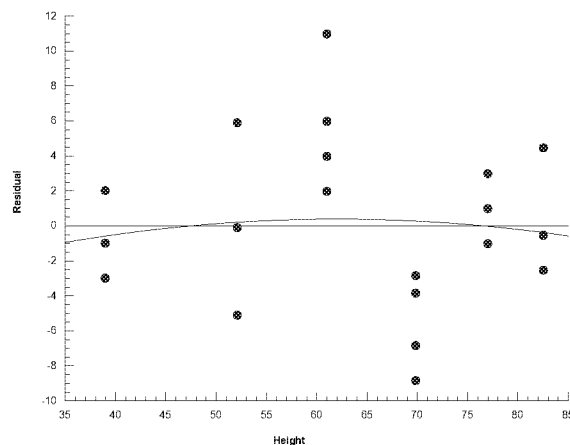
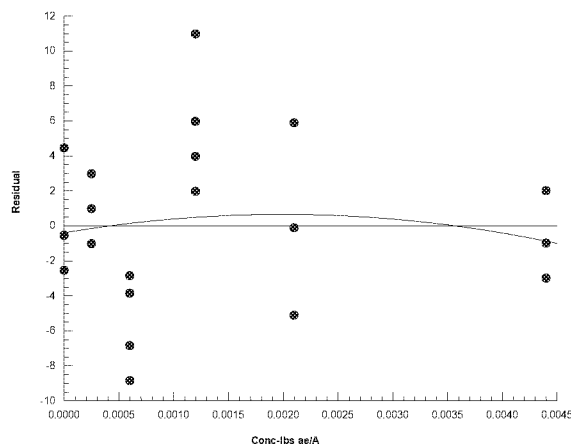
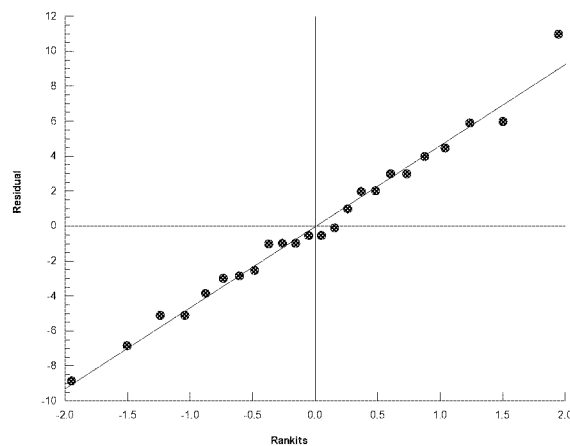
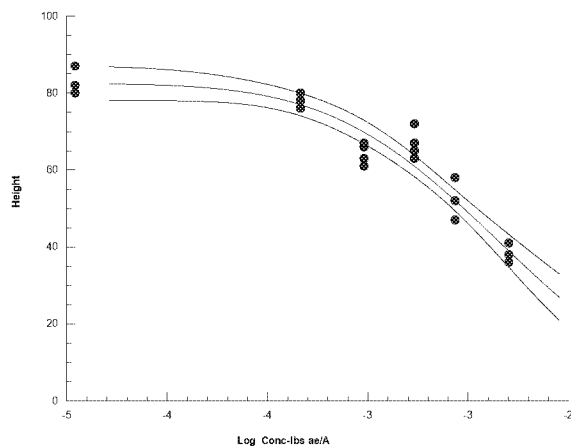
Stone Environmental, Inc.

Analysis ID: 20-9475-5438
Analyzed: 31 Mar-20 19:31
Endpoint: Height
Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.5
Status Level: 1

Graphics

Model: 3P Cum Log-Normal (Probit): $\mu = \alpha \cdot [1 - \Phi(\log[x/\delta]/\gamma)]$ Distribution: Normal [$\omega=1$]



CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 3 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 11-8407-7761	Endpoint: Weight	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:31	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 04-0546-4430	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 09 Aug-19	Protocol: OCSP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 89d 0h	Taxon:	Source: Age: R1

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Cum Log-Normal (Probit): $\mu = \alpha [1 - \Phi[\log[x/\delta]/\gamma]]$	Normal [$\omega=1$]	Off [$\mu^*=\mu$]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision($\alpha:5\%$)
5	-124	255	257	0.8719	5.27%	3470	Yes	3.41	0.0398	Significant Lack of Fit

Point Estimates

Level	lbs ae/A	95% LCL	95% UCL
IC5	0.00015	4.56E-05	0.000284
IC10	0.00036	0.000211	0.000547
IC25	0.00156	0.00125	0.00191
IC50	0.00793	0.00519	0.0121

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision($\alpha:5\%$)
α	3470	88	3290	3650	39.4	<1.0E-37	Significant Parameter
γ	2.41	0.352	1.68	3.14	6.86	8.8E-07	Significant Parameter
δ	0.00793	0.00158	0.00464	0.0112	5.01	5.8E-05	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision($\alpha:5\%$)
Model	196000000	65200000	3	1980	<1.0E-37	Significant
Lack of Fit	251000	83600	3	3.41	0.0398	Significant
Pure Error	441000	24500	18			
Residual	692000	32900	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision($\alpha:5\%$)
Outlier	Grubbs Extreme Value Test	1.94	2.8	1.0000	No Outliers Detected
Variance	Bartlett Equality of Variance Test	3.23	11.1	0.6649	Equal Variances
	Mod Levene Equality of Variance	0.231	2.77	0.9441	Equal Variances
Distribution	Anderson-Darling A2 Normality Test	0.354	2.49	0.4668	Normal Distribution
	Shapiro-Wilk W Normality Test	0.97	0.917	0.6623	Normal Distribution

Weight Summary

			Calculated Variate						
Conc-lbs ae/A	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	3470	3140	3610	112	224	6.46%	0.0%
0.00025		4	3280	3120	3390	62	124	3.78%	5.51%
0.0006		4	2780	2650	2940	59.8	120	4.30%	19.9%
0.0012		4	2820	2740	3050	76.4	153	5.41%	18.6%
0.0021		4	2530	2280	2750	96	192	7.59%	27.2%
0.0044		4	2020	1900	2080	41	81.9	4.06%	41.9%

CETIS Analytical Report

Report Date: 31 Mar-20 19:33 (p 4 of 4)
Test Code/ID: 50958206 direpr / 02-2725-9576

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

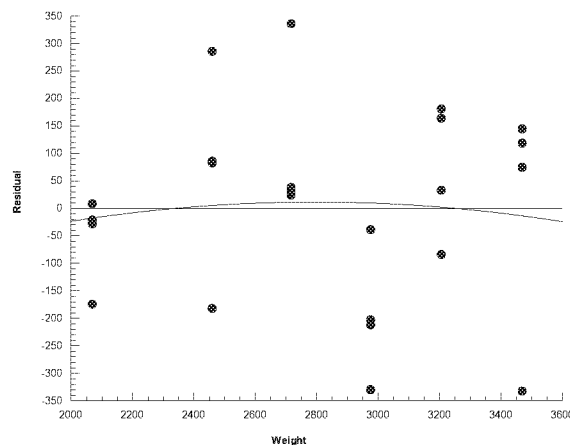
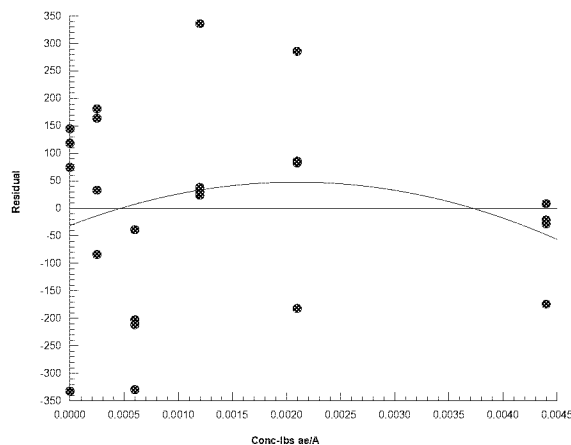
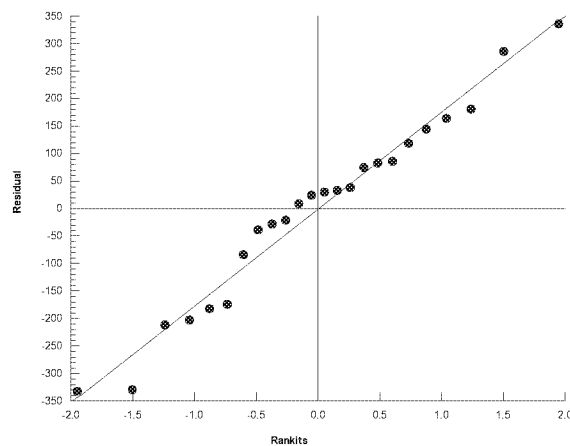
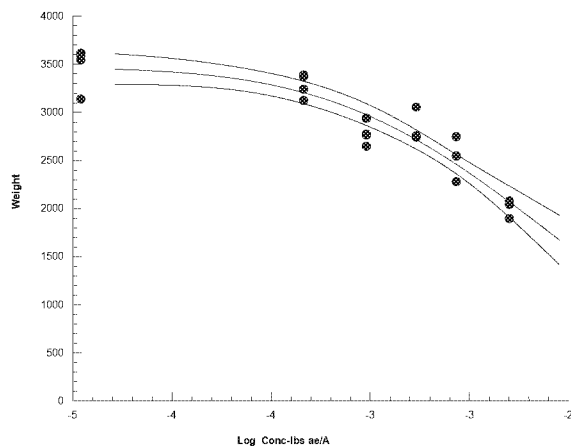
Stone Environmental, Inc.

Analysis ID: 11-8407-7761 Endpoint: Weight
Analyzed: 31 Mar-20 19:31 Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.5
Status Level: 1

Graphics

Model: 3P Cum Log-Normal (Probit): $\mu = \alpha \cdot [1 - \Phi[\log(x/\delta)/\gamma]]$ Distribution: Normal [$\omega=1$]



CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 1 of 8)

Test Code/ID: 50958206 diverg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 18-4268-9682	Endpoint: Height	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 23:14	Analysis: Nonparametric-Control vs Ord. Treatments	Status Level: 1
Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3
Sample ID: 07-1673-7711	Code: 50958206 diverg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	0.00058	0.0012	0.0008343	

Jonckheere-Terpstra Step-Down Test

Control	vs	Conc-lbs ae/	Test Stat	Critical	Ties	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00028	1.61	1.64	2	Asymp	0.0809	Non-Significant Effect
		0.00058	1.4	1.64	3	Asymp	0.0809	Non-Significant Effect
		0.0012*	2.58	1.64	4	Asymp	0.0049	Significant Effect
		0.0022*	3.83	1.64	5	Asymp	6.3E-05	Significant Effect
		0.0046*	4.75	1.64	7	Asymp	1.0E-06	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2515.71	503.142	5	16.7	3.3E-06	Significant Effect
Error	541.25	30.0694	18			
Total	3056.96		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	10.3	15.1	0.0661	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.88	0.884	0.0083	Non-Normal Distribution

Height Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	69.8	62.5	77	71.5	63	73	2.29	6.56%	0.00%
0.00028		4	59	44.1	73.9	63.5	45	64	4.67	15.84%	15.41%
0.00058		4	60.5	49.1	71.9	62.5	51	66	3.57	11.80%	13.26%
0.0012		4	51	48.4	53.6	51	49	53	0.816	3.20%	26.88%
0.0022		4	43.2	37.2	49.3	44.5	38	46	1.89	8.73%	37.99%
0.0046		4	40.2	37	43.5	40.5	38	42	1.03	5.12%	42.29%

Height Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	63	72	73	71
0.00028		64	64	45	63
0.00058		51	59	66	66
0.0012		49	53	51	51
0.0022		46	43	38	46
0.0046		42	38	39	42

CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 2 of 8)
Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

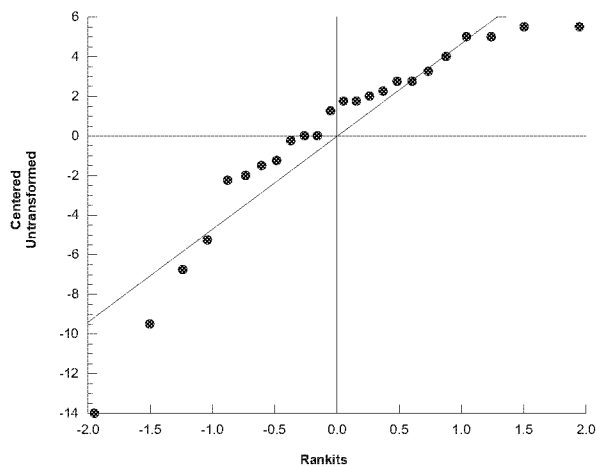
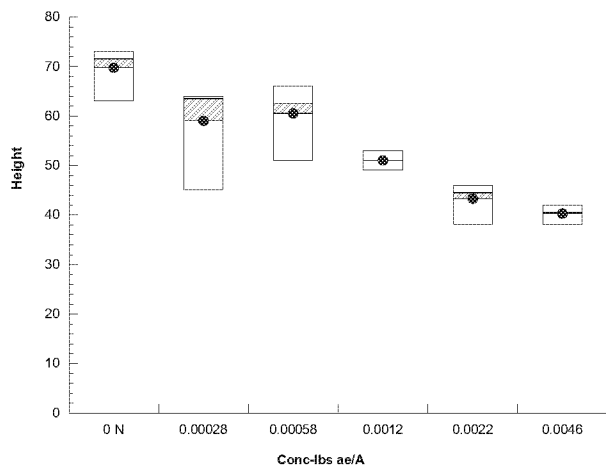
Stone Environmental, Inc.

Analysis ID: 18-4268-9682
Analyzed: 31 Mar-20 23:14

Endpoint: Height
Analysis: Nonparametric-Control vs Ord. Treatments

CETIS Version: CETISv1.9.5
Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 3 of 8)

Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 08-8060-5534	Endpoint: Height	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:34	Analysis: Nonparametric-Two Sample	Status Level: 1
Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3
Sample ID: 07-1673-7711	Code: 50958206 diveg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	0.00058	0.0012	0.0008343		10.80%

Mann-Whitney U Two-Sample Test

Control	vs	Conc-lbs ae/	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00028	13.5	n/a	1	6	Exact	0.0714	Non-Significant Effect
		0.00058	14	n/a	0	6	Exact	0.0571	Non-Significant Effect
		0.0012*	16	n/a	0	6	Exact	0.0143	Significant Effect
		0.0022*	16	n/a	0	6	Exact	0.0143	Significant Effect
		0.0046*	16	n/a	0	6	Exact	0.0143	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.89	2.8	0.0334	Outlier Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2515.71	503.142	5	16.7	3.3E-06	Significant Effect
Error	541.25	30.0694	18			
Total	3056.96		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	10.3	15.1	0.0661	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.88	0.884	0.0083	Non-Normal Distribution

Height Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	69.8	62.5	77	71.5	63	73	2.29	6.56%	0.00%
0.00028		4	59	44.1	73.9	63.5	45	64	4.67	15.84%	15.41%
0.00058		4	60.5	49.1	71.9	62.5	51	66	3.57	11.80%	13.26%
0.0012		4	51	48.4	53.6	51	49	53	0.816	3.20%	26.88%
0.0022		4	43.2	37.2	49.3	44.5	38	46	1.89	8.73%	37.99%
0.0046		4	40.2	37	43.5	40.5	38	42	1.03	5.12%	42.29%

Height Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	63	72	73	71
0.00028		64	64	45	63
0.00058		51	59	66	66
0.0012		49	53	51	51
0.0022		46	43	38	46
0.0046		42	38	39	42

CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 4 of 8)
Test Code/ID: 50958206 diveg / 01-9886-1401

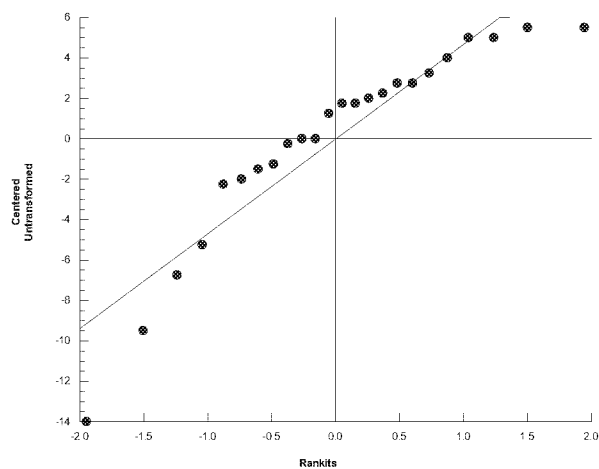
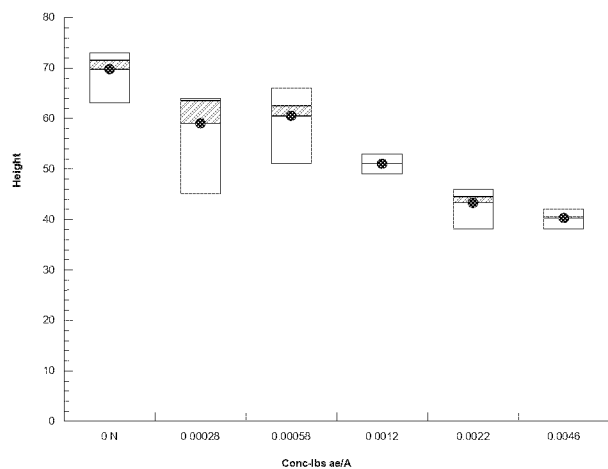
OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 08-8060-5534
Analyzed: 31 Mar-20 19:34
Endpoint: Height
Analysis: Nonparametric-Two Sample

CETIS Version: CETISv1.9.5
Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 5 of 8)

Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 07-5460-9502	Endpoint: Weight	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:34	Analysis: Parametric-Control vs Treatments	Status Level: 1
Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3
Sample ID: 07-1673-7711	Code: 50958206 diveg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	<0.00028	0.00028	n/a		13.89%

Dunnett Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00028*	3.27	2.41	499	6	CDF	0.0088	Significant Effect
		0.00058*	3.38	2.41	499	6	CDF	0.0070	Significant Effect
		0.0012*	3.72	2.41	499	6	CDF	0.0033	Significant Effect
		0.0022*	5.04	2.41	499	6	CDF	2.2E-04	Significant Effect
		0.0046*	6.13	2.41	499	6	CDF	4.6E-05	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.14	2.8	0.6053	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3716210	743243	5	8.64	2.6E-04	Significant Effect
Error	1549030	86057.4	18			
Total	5265250		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	4.67	15.1	0.4572	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.963	0.884	0.5062	Normal Distribution

Weight Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	3590	3300	3890	3530	3450	3870	93	5.18%	0.00%
0.00028		4	2920	2340	3490	3060	2380	3170	180	12.32%	18.86%
0.00058		4	2890	2170	3620	2920	2340	3400	227	15.69%	19.50%
0.0012		4	2820	2600	3040	2780	2710	3020	68.2	4.84%	21.49%
0.0022		4	2550	2160	2940	2610	2200	2770	123	9.63%	29.08%
0.0046		4	2320	1910	2740	2330	2000	2630	130	11.21%	35.36%

Weight Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	3450	3520	3870	3530
0.00028		3030	3170	2380	3090
0.00058		2340	2760	3400	3080
0.0012		2770	2710	3020	2780
0.0022		2770	2570	2200	2660
0.0046		2300	2370	2000	2630

CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 6 of 8)
Test Code/ID: 50958206 diveg / 01-9886-1401

OCSP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

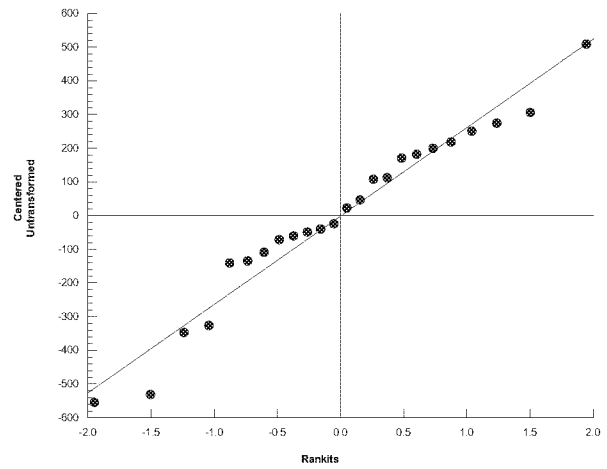
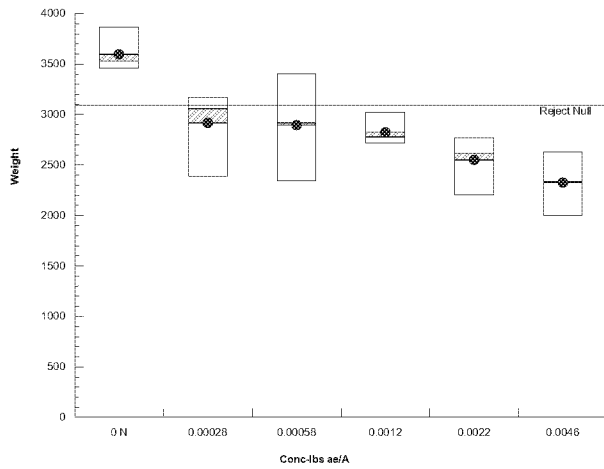
Stone Environmental, Inc.

Analysis ID: 07-5460-9502
Analyzed: 31 Mar-20 19:34

Endpoint: Weight
Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.9.5
Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 7 of 8)

Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 11-3012-8646	Endpoint: Weight	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:34	Analysis: Parametric-Control vs Ord.Treatments	Status Level: 1
Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3
Sample ID: 07-1673-7711	Code: 50958206 diveg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	<0.00028	0.00028	n/a		10.78%

Williams Multiple Comparison Test

Control	vs	Control II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Negative Control		0.00028*	3.27	1.73	360	6	CDF	<0.05	Significant Effect
		0.00058*	3.38	1.82	377	6	CDF	<0.05	Significant Effect
		0.0012*	3.72	1.85	383	6	CDF	<0.05	Significant Effect
		0.0022*	5.04	1.86	386	6	CDF	<0.05	Significant Effect
		0.0046*	6.13	1.87	387	6	CDF	<0.05	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:5%)
Outlier	Grubbs Extreme Value Test	2.14	2.8	0.6053	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3716210	743243	5	8.64	2.6E-04	Significant Effect
Error	1549030	86057.4	18			
Total	5265250		23			

ANOVA Assumptions Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variance	Bartlett Equality of Variance Test	4.67	15.1	0.4572	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.963	0.884	0.5062	Normal Distribution

Weight Summary

Conc-lbs ae/A	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	N	4	3590	3300	3890	3530	3450	3870	93	5.18%	0.00%
0.00028		4	2920	2340	3490	3060	2380	3170	180	12.32%	18.86%
0.00058		4	2890	2170	3620	2920	2340	3400	227	15.69%	19.50%
0.0012		4	2820	2600	3040	2780	2710	3020	68.2	4.84%	21.49%
0.0022		4	2550	2160	2940	2610	2200	2770	123	9.63%	29.08%
0.0046		4	2320	1910	2740	2330	2000	2630	130	11.21%	35.36%

Weight Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	3450	3520	3870	3530
0.00028		3030	3170	2380	3090
0.00058		2340	2760	3400	3080
0.0012		2770	2710	3020	2780
0.0022		2770	2570	2200	2660
0.0046		2300	2370	2000	2630

CETIS Analytical Report

Report Date: 31 Mar-20 23:16 (p 8 of 8)
Test Code/ID: 50958206 diveg / 01-9886-1401

OCSP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

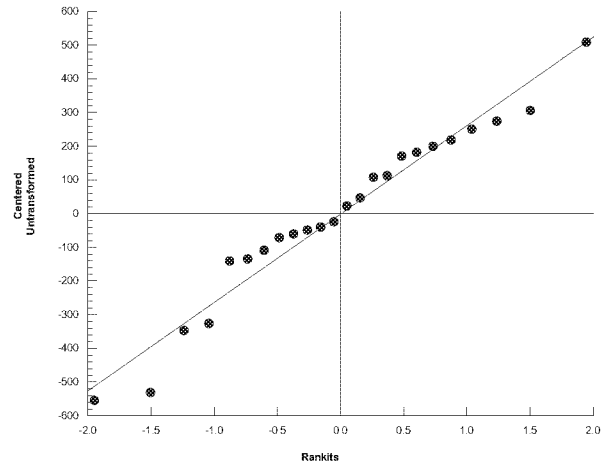
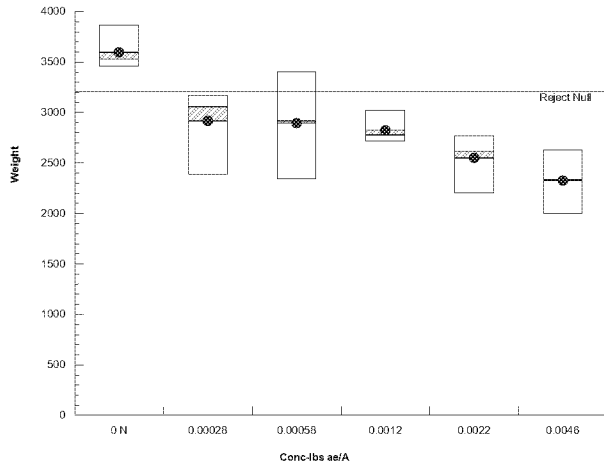
Stone Environmental, Inc.

Analysis ID: 11-3012-8646
Analyzed: 31 Mar-20 19:34

Endpoint: Weight
Analysis: Parametric-Control vs Ord.Treatments

CETIS Version: CETISv1.9.5
Status Level: 1

Graphics



CETIS Analytical Report

Report Date: 31 Mar-20 23:17 (p 1 of 4)

Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 00-6015-2453	Endpoint: Height	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:34	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3
Sample ID: 07-1673-7711	Code: 50958206 diveg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Cum Log-Normal (Probit): $\mu=\alpha \cdot [1 - \Phi[\log[x/\delta]/\gamma]]$	Normal [$\omega=1$]	Off [$\mu^*=\mu$]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision($\alpha:5\%$)
5	-40.1	87.5	89.8	0.7662	8.23%	69.7	Yes	1.23	0.3264	Non-Significant Lack of Fit

Point Estimates

Level	lbs ae/A	95% LCL	95% UCL
IC5	0.0000729	n/a	0.000222
IC10	0.000199	0.0000618	0.00042
IC25	0.00107	0.000725	0.00152
IC50	0.0069	0.00372	0.0128

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision($\alpha:5\%$)
α	69.7	2.76	63.9	75.4	25.3	<1.0E-37	Significant Parameter
γ	2.77	0.56	1.6	3.93	4.94	7.0E-05	Significant Parameter
δ	0.0069	0.00211	0.0025	0.0113	3.26	0.0037	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision($\alpha:5\%$)
Model	72300	24100	3	775	<1.0E-37	Significant
Lack of Fit	111	37.1	3	1.23	0.3264	Non-Significant
Pure Error	541	30.1	18			
Residual	653	31.1	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision($\alpha:5\%$)
Outlier	Grubbs Extreme Value Test	3.02	2.8	0.0168	Outlier Detected
Variance	Mod Levene Equality of Variance	0.635	2.77	0.6757	Equal Variances
Distribution	Anderson-Darling A2 Normality Test	1.09	2.49	0.0075	Non-Normal Distribution
	Shapiro-Wilk W Normality Test	0.896	0.917	0.0173	Non-Normal Distribution

Height Summary

Conc-lbs ae/A	Code	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	69.8	63	73	2.29	4.57	6.56%	0.0%
0.00028		4	59	45	64	4.67	9.35	15.80%	15.4%
0.00058		4	60.5	51	66	3.57	7.14	11.80%	13.3%
0.0012		4	51	49	53	0.816	1.63	3.20%	26.9%
0.0022		4	43.2	38	46	1.89	3.77	8.73%	38.0%
0.0046		4	40.2	38	42	1.03	2.06	5.12%	42.3%

CETIS Analytical Report

Report Date: 31 Mar-20 23:17 (p 2 of 4)
Test Code/ID: 50958206 diveg / 01-9886-1401

OCSP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 00-6015-2453
Analyzed: 31 Mar-20 19:34
Endpoint: Height
Analysis: Nonlinear Regression (NLR)

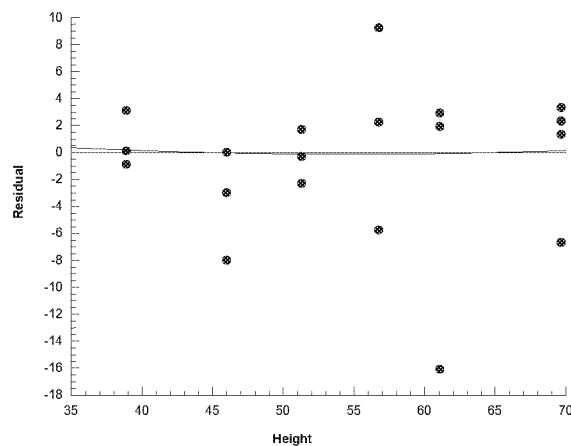
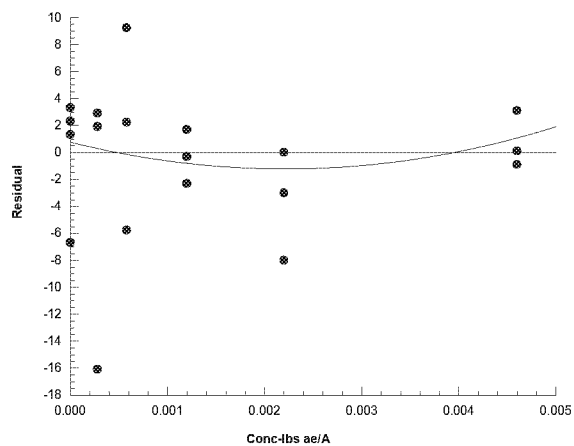
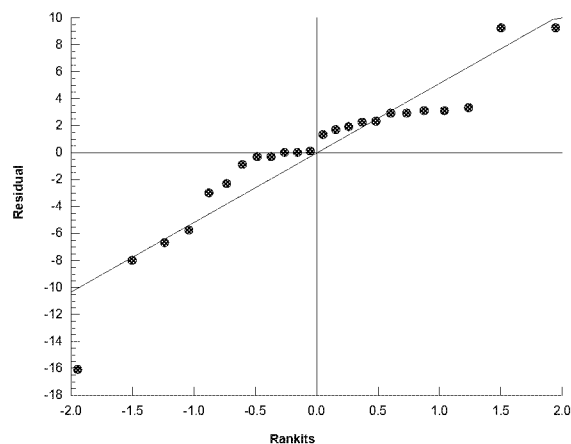
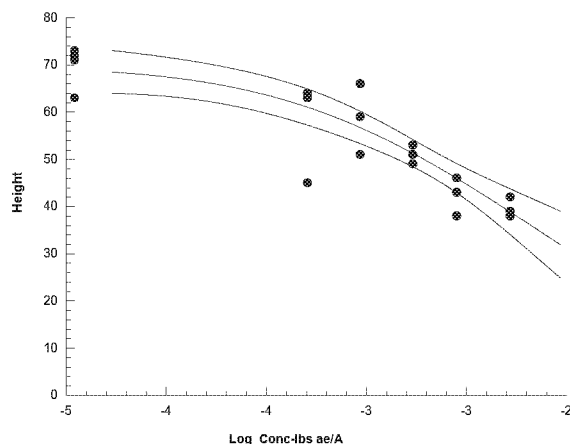
CETIS Version: CETISv1.9.5
Status Level: 1

Height Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	63	72	73	71
0.00028		64	64	45	63
0.00058		51	59	66	66
0.0012		49	53	51	51
0.0022		46	43	38	46
0.0046		42	38	39	42

Graphics

Model: 3P Cum Log-Normal (Probit): $\mu = \alpha[1 - \Phi[\log(x/\delta)/\gamma]]$ Distribution: Normal [$\omega=1$]



CETIS Analytical Report

Report Date: 31 Mar-20 23:17 (p 3 of 4)

Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 04-0035-7898	Endpoint: Weight	CETIS Version: CETISv1.9.5
Analyzed: 31 Mar-20 19:34	Analysis: Nonlinear Regression (NLR)	Status Level: 1
Batch ID: 04-3508-1290	Test Type: Vegetative Vigor Tier II	Analyst:
Start Date: 30 Jul-19	Protocol: OCSPP 850.4150 Plant Vegetative Vigor	Diluent:
Ending Date: 06 Nov-19	Species: Glycine max	Brine:
Test Length: 99d 0h	Taxon:	Source: Age: V3
Sample ID: 07-1673-7711	Code: 50958206 diveg	Project:
Sample Date: 30 Jul-19	Material: Dicamba DGA	Source: Syngenta Crop Protection LLC
Receipt Date:	CAS (PC):	Station:
Sample Age: n/a	Client: CDM Smith - K. Bozicevich	

128931 50958206; Soybean yield; Vegetative growth stage (V3)

Non-Linear Regression Options

Model Name and Function	Weighting Function	PTBS Function	X Trans	Y Trans
3P Cum Log-Normal (Probit): $\mu = \alpha [1 - \Phi[\log[x/\delta]/\gamma]]$	Normal [$\omega=1$]	Off [$\mu^*=\mu$]	None	None

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	PMSD	Thresh	Optimize	F Stat	P-Value	Decision($\alpha:5\%$)
6	-134	275	278	0.6574	8.11%	3590	Yes	0.379	0.7694	Non-Significant Lack of Fit

Point Estimates

Level	lbs ae/A	95% LCL	95% UCL
IC5	0.0000111	n/a	0.000118
IC10	0.0000657	2.94E-06	0.000342
IC25	0.00129	0.000705	0.00225
IC50	0.0353	0.00441	0.282

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision($\alpha:5\%$)
α	3590	140	3300	3880	25.7	<1.0E-37	Significant Parameter
γ	4.9	1.52	1.74	8.07	3.22	0.0041	Significant Parameter
δ	0.0353	0.0342	-0.0359	0.106	1.03	0.3143	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision($\alpha:5\%$)
Model	198000000	66200000	3	844	<1.0E-37	Significant
Lack of Fit	97800	32600	3	0.379	0.7694	Non-Significant
Pure Error	1550000	86100	18			
Residual	1650000	78400	21			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision($\alpha:5\%$)
Outlier	Grubbs Extreme Value Test	2.32	2.8	0.3356	No Outliers Detected
Variance	Bartlett Equality of Variance Test	4.67	11.1	0.4572	Equal Variances
	Mod Levene Equality of Variance	0.88	2.77	0.5139	Equal Variances
Distribution	Anderson-Darling A2 Normality Test	0.603	2.49	0.1185	Normal Distribution
	Shapiro-Wilk W Normality Test	0.952	0.917	0.3031	Normal Distribution

Weight Summary

Weight Summary			Calculated Variate						
Conc-lbs ae/A	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	N	4	3590	3450	3870	93	186	5.18%	0.0%
0.00028		4	2920	2380	3170	180	359	12.30%	18.9%
0.00058		4	2890	2340	3400	227	454	15.70%	19.5%
0.0012		4	2820	2710	3020	68.2	136	4.84%	21.5%
0.0022		4	2550	2200	2770	123	245	9.63%	29.1%
0.0046		4	2320	2000	2630	130	260	11.20%	35.4%

CETIS Analytical Report

Report Date: 31 Mar-20 23:17 (p 4 of 4)
Test Code/ID: 50958206 diveg / 01-9886-1401

OCSPP 850.4150 Terrestrial Plant Tier II (Vegetative Vigor)

Stone Environmental, Inc.

Analysis ID: 04-0035-7898 Endpoint: Weight
Analyzed: 31 Mar-20 19:34 Analysis: Nonlinear Regression (NLR)

CETIS Version: CETISv1.9.5
Status Level: 1

Weight Detail

Conc-lbs ae/A	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	N	3450	3520	3870	3530
0.00028		3030	3170	2380	3090
0.00058		2340	2760	3400	3080
0.0012		2770	2710	3020	2780
0.0022		2770	2570	2200	2660
0.0046		2300	2370	2000	2630

Graphics

Model: 3P Cum Log-Normal (Probit): $\mu = \alpha \cdot [1 - \Phi[\log[x/\delta]/\gamma]]$ Distribution: Normal [$\omega=1$]

